"ECONOMIC AND COMMERCIAL ASPECTS OF THE PHOSPHATE ROCK INDUSTRY IN JORDAN AND ITS RELATION TO WORLD PRODUCTION AND TRADE IN PHOSPHATES"

BY

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ABSTRACT

The phosphate rock industry is a key industry for the Jordanian economy being both the largest industrial employer and the main source of Foreign exchange earnings. The production and marketing activities of the Jordan Phosphate Mines Company have been affected by developments in the world phosphate rock industry and the Jordanian economy.

Data for this research has been collected from both published and unpublished material. In addition, field observations, personal interviews and informal talks with key personnel and other members of staff of the Jordan Phosphate Mines Company were important.

Part of this thesis provides a background by reviewing developments in the world phosphate rock industry, in particular the availability and geology of phosphate deposits, production, consumption and the main uses of phosphate rock, present and future balances of supply and demand, and marketing aspects of the world industry. The thesis, also reviews developments in the Jordanian economy in order to understand better the phosphate rock industry in Jordan, since it operates within that economic sphere.

Economic and commercial aspects of the Jordanian phosphate rock industry related to the geology of phosphate deposits, reserves, developments in production and costs, marketing process, pricing policies and practices and transportation are discussed.

This research also attempts to evaluate the efficiency and performance of the Jordan Phosphate Mines Company, to estimate a demand function for world phosphates, to forecast world demand, and to estimate a production function for the Jordanian phosphate industry. Estimation and forecasting are carried out with the aid of multiple regression.

Finally, the last chapter brings together the analysis and conclusions

of the earlier chapters on the economic and commercial aspects of the Jordanian phsophate rock industry and its relation to world production and trade in phosphates.

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INTRODUCTION

The main purpose of this research is to analyse the economic and commercial aspects of the Jordanian phosphate rock industry and its relation to world production and trade in phosphates.

Phosphate is of considerable importance, as it is the source of phosphorus, an essential element for all living matter. There are abundant natural deposits of phosphates. The commercial viability of these deposits of phosphates, however, depends mainly on their size, their geological situation and suitability for exploitation, the feasibility of benefication and processing, their chemical and physical composition, the accessibility of markets, and their potential for profits. Trade in phosphate rock generally takes place according to the T.C.P. or B.P.L. content. The rock is usually graded according to its phosphorus pentoxide (P_2O_5) content, or the actual phosphorus, P, content.

Of the world production of phosphate rock, 85 percent is consumed in the manufacture of phosphate fertilizers and their variants. The remaining 15 percent is consumed in different industrial products and processes, such as the manufacture of detergents, pharmaceuticals and insecticides, to name but a few.

Phosphate deposits cover about 60 percent of the total area of Jordan. Phosphate was first discovered in 1908, although it was not until 1934 that it was mined commercially on a very limited scale. In 1953, the Jordanian Phosphate Mines Company was formed with equity capital of one million Jordanian Dinars and became the sole producer and exploiter of phosphate deposits in Jordan. Its capital had grown to JD 10 million by 1976, with the Government owning 89.9 percent of the company's shares.

Phosphate rock deposits are currently exploited at Russeifa and El-Hassa. The average weight recovery of marketable phosphate at Russeifa ranges between 32 and 51 percent, while that at El-Hassa ranges between 55 and 68 percent.

As a result of the 1967 June War and the decline in the world price of phosphate rock, production at both Russeifa and El-Hassa mines declined. However, by 1972 the world phosphate rock market experienced a shortage in supply accompanied by an increase in demand. By mid-1973, a serious shortage of phosphate rock in the world market had developed and consequently phosphate prices soared. The recovery in the world market for phosphate rock stimulated heavy investment by existing producers to increase capacity in order to benefit from the new market conditions. It also encouraged new producers to enter the market. The expansion plans of Jordan and Morocco are discussed in detail. Jordan had hoped to produce 10 million tons per year by 1980, but this plan was revised after consideration of the probable fall in price resulting from the possible excess capacity and/or a decline in world demand. The revised plan called for the production of 6.1 million tons per year by 1981, compared with a capacity of 1.36 million tons per year of dry product in 1975.

The phosphate rock industry is one of Jordan's key industries in terms of production, employment, and earnings of foreign exchange. In 1975, it provided employment for 2,514 persons, was responsible for 30.8 percent of the country's total exports, and constituted 6 percent of GDP. The industry has been affected both by developments in the world phosphate rock industry and in the Jordanian economy.

CHAPTER ONE: WORLD PRODUCTION OF PHOSPHATE ROCK

The importance of phosphate rock stems from the world's need for the natural resource 'phosphorus' which is widely used in agriculture and industry. However, before discussing some important aspects of phosphorus, it is useful to consider natural resources as a whole.

The United Nations has defined a natural resource as:

> '... anything found by man in his natural environment that he may in some way utilize for his own benefit. As such, natural resources provided by nature include: rocks which contain mineral ore, energy sources (oil, coal, gas, etc..), and other useful products (ground-water, building stones, etc...); soils which nourish the plants, as well as, all plant and animal life; elements of landscape which provide sites for building roads, railways, and other structures; surface and underground waters which are indispensible to human, animal, and plant life; and air and everything that constitutes the atmosphere or reaches man by way of atmosphere such as solar radiation. However, it is more convenient and customary to apply the term natural resources to the elements and conditions of the environment which at a given time and in the framework of a given technological stage of development, appear particularly valuable to human welfare, either at present or in the foreseeable future. Therefore, the principal criterion for a "natural resource" is its potential usability.'[1]

Natural resources are classified either as renewable - e.g. water, plants, and forests, or non-renewable - e.g. minerals. Taking this division further, mineral resources are classified either as those which can be utilized at an early date or those which are not likely to be utilized until other resources, already being exploited, have been largely exhausted. However, the point at which the second category, namely the reserve resources, is exploited depends upon: the activity of the market; the interest of users; the means of transport and utilization; the stage of production; and the availability of substitutes.[2]

Furthermore, the economic importance of natural resources to development is well recognized by both developed and developing economies. Such

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1. United Nations, Natural Resources of Developing Countries: Investigation, Development, and Rational Utilization, (New York: U.N. Publications, 1970), pp. 4-6.

2. Ibid., p. 7.

resources, together with capital, human resources, and the established technology, therefore, constitute the total economic assets. The development process, consists mainly of organising the productive exploitation of natural resources in the interests of the whole community. Hence, one of the main tasks confronting any country, particularly a developing one, is to make better use of its natural resources since its economic life revolves around the exploitation and use of these in agriculture, mining, industry and transport. Economic development, however, requires a detailed knowledge of a country's available natural resources and the technical process involved in the development and use of such resources. Such knowledge is essential for drawing up economic and social development plans.

In this respect, the Charter of the United Nations emphasised that every country has an inalienable right of sovereignty over its own natural resources, and therefore must be able to exercise such a right, in the interests of its own development without any restrictions as to the choice of priorities, methods of development to be employed, or the results to be achieved.[1] At the same time, the Charter urged that the resources of the entire world should be developed rationally to the fullest extent possible with all available means.[2]

Therefore, one can conclude that, particularly at a time when world population is growing so rapidly, mankind can only progress by making efficient use of the world's available natural resources.

PART ONE. OCCURRENCE OF PHOSPHATE DEPOSITS

Phosphate rock is a very general term applied to any rock containing over 20 percent phosphorus pentoxide (P_2O_5).[3] It is a mixture of several

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1. Ibid., p. 27.

2. Ibid., p. 27.

3. D. B. Brbst and W. P. Pratle (eds.), Geological Survey Professional, Paper 820, (Washington D.C.: United States Government Printing Office, 1973), p. 515.

phosphate minerals, in commercial quantities, and various impurities. The mixture, however, includes: phosphatized limestones; sand stone; shales; igneous rocks; nodular phosphates; residual, weathered phosphatic limestones; vein phosphates; and consolidated and unconsolidated phosphatic sediments. Mineralogically, it consists largely of one or more of the related calcium phosphates in submicrocrystalline form, with varying proportions of other organic or inorganic substances.

The types of phosphate rock range from soft, unconsolidated sand and gravel to hard, massive, flint-like rock with gravity ranging from 2 to 3 and colour from white to coal black.[1] Phosphate rock deposits have been formed in many different geological periods from the Pre-Cambrian to the Quaternary.

The natural resource 'phosphorus' is vital to plant growth. The total amount of this resource, reported as phosphorus pentoxide and tricalcium phosphate (T.C.P.) or bone phosphate of lime (B.P.L.), throughout the solid sphere of the earth equals (11×10^{24})grammes or (10^{19}) tons.[2] Essentially, all naturally occurring phosphorus compounds are orthophosphates, although a pyrophosphate mineral has also been found in the West Indies.

Phosphorus is found in recoverable concentrations in three principal environments: guano or deposits derived from guano; igneous apatites; and marine phosphate deposits or sedimentary phosphorite. Guano is formed in large quantities on the earth's surface by sea-birds, and also in smaller quantities in caves, mainly by bats. Decomposed guano consists mainly of calcium phosphates whereas slightly decomposed guano consists of ammonium and alkali oxalates, sulphates, nitrates, magnesium and ammonium-magnesium phosphates. These deposits occur mainly on the islands off the coast of

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1. University of Maryland, Atlas of the World's Resources: The Mineral Resources of the World, (New York: Prentice-Hall Inc., 1952), p.141.

2. J. R. Van Wazer, Phosphorus and its Compounds,(New York: Interscience Publishers Inc., 1961), p. 956.

Peru, other coasts in the southern Pacific, and off the western coast of Africa. They also occur in some islands in the Southern Seas, Curacao, Aruba, and the West Indies. The production of phosphate from these deposits constitutes a yearly average of about 8 percent of total world output.[1]

Igneous apatites, on the other hand, are found in trusive masses or sheets. They are mainly found as intrusive masses associated with alkaline igneous rocks including carbonite, ijolite, nepheline syenite, and pyroxenite. They occur as large deposits in the Kola Peninsula (U.S.S.R.), eastern Uganda, Palabora in Africa, and Araxa and Jacupiranya in Brazil. Smaller deposits are also found in Canada, Norway, Sweden, and Spain. The phosphate mineral in this type is fluorapatite with a (P_2O_5) content as high as 36 percent. The phosphate rock produced from this type of deposit accounts for an annual average of about 17 percent of world output.[2]

The third type of phosphate deposit is the sedimentary phosphorite. These deposits are characterized by a suite of rocks consisting of black shale, phosphatic shale, phosphorite, dolomite, chert or diatomite, saline deposits, and red or light coloured sandstone or shale. The rocks grade laterally into one another and the sequence may also be repeated vertically. In these rocks, the phosphate is carbonaceous and consists of pellets, nodules, minor phosphatized bone material, and shale. Individual beds may be several feet thick and contain 30 percent or more (P_2O_5) and extend over hundreds of square miles.[3] The richest and largest deposits of this type form in the warm latitudes and in areas of upwelling caused by divergence. Such deposits are found in U.S.A., Belgium, France, the West Indies, Peru, the Pacific Islands, Karatan in the U.S.S.R., northern Alaska, Brazil, western and northern Africa, and the Middle East. The reserves and resources

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1. D. A. Brbst and W. P. Pratle, <u>op. cit.</u>, p. 528.
2. <u>Ibid.</u>, p. 518.
3. <u>Ibid.</u>, p. 518.

of this type of deposit are moderate and can serve best as local sources of phosphate rock. The sedimentary phosphorite deposits are generally lower in the amount of phosphate per unit area and therefore, must be further up-graded by some method of benefication to provide an economic product. (Benefication is a process that involves washing, classifying, floating, and thickening in order to raise the phosphate content and reduce that of iron and aluminium oxides).

The main areas in which phosphate rock deposits occur are[1]: the United States, Russia, Morocco, Algeria, Tunisia and Jordan. In the United States, the phosphate rock deposits now commercially important are in Florida, Tennessee, Idaho, Montana and Wyoming. Florida deposits were formed from phosphate materials in the marine (Miocene) limestone. The hard rock deposits in Florida are up to one hundred feet thick, covered with about fifty feet of overburden. They contain about 82 percent tricalcium phosphate. The land-pebble phosphate rock deposits in Florida, however, are between one and forty-five feet thick, covered with about fifty feet of overburden. They contain roughly 50 percent tricalcium phosphate.

In Russia, the most important phosphate deposits are the huge apatite deposits of the Kola Peninsula where large Devonian intrusives of apatite-nepheline rocks occur in the old rocks of the Khibine Massif of the Pre-Cambrian Scandinavian shield. The sedimentary phosphates, on the other hand, occur in various parts of European and Asiatic Russia, namely in Viatka, Egorievsk, Saratov, Syzran, Kineshma, Sterlikamsk, Podolia, Ukrania, Kazakstan, Kara-Kalpka, and Tadzhik.

Deposits of phosphate rock occurring in Morocco, Algeria and Tunisia lie in sedimentary beds of Eocene age at various depths below the surface and are of varying thickness. The higher-grade product comes from Morocco.

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1. For details on the geology of the deposits in the main areas, see, University of Maryland, op. cit., p. 141.

Most of Morocco's phosphate rock deposits contain several beds, ranging in thickness from one to twenty-five feet or more, and separated by limestone, clay and marl. At present, phosphate rock is mainly produced from deposits in Khouribga and Louis Gentil. The deposits at Khouribga lie on a gently sloping plateau about 125 miles from the port of Casablanca. They consist of a bed ten feet thick and are mined underground by the room-and-pillar method. The phosphate rock produced from this area is fragile and requires very little treatment. It contains about 75 percent tricalcium phosphate.[1] The phosphate rock produced at Louis Gentil has the same characteristics as that at Khouribga except that its tricalcium phosphate content does not exceed 70 percent.[2]

In Algeria, there are three principal areas with large phosphate rock deposits. At Djebel Kouif phosphate rock deposits occur in five spearate beds. These beds are between one and ten feet thick, and contain approximately 72 percent tricalcium phosphate.[3] Phosphate rock deposits at Djebel Ouk, on the other hand, occur in beds of between 60 and 200 feet thick, and contain about 66 percent tricalcium phosphate, whereas deposits at Tocqueville yield phosphate rock with an entirely different character.[4] Output from this area is chiefly exported in a coarse form and used in the European metallurgical industry because of its hardness.

Phosphate rock deposits in Tunisia occur in Metlaoui, Redeyet, Ain-Moulares, M'dilla, and Kalat-Djerda and are usually contained in two beds of five to ten feet thick each. The two beds, however, are separated by a few feet of thin-bedded limestone and low-grade phosphate rock. The tricalcium phosphate content in these deposits ranges from 58 percent to 70 percent.[5]

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1. Ibid., p. 142.
2. Ibid., p. 142.
3. Ibid., p. 142.
4. Ibid., p. 142.
5. Ibid., p. 143.

Finally, phosphate rock deposits in Jordan cover approximately 60 percent of the country's area. They are located in the Upper Cretaceous and Eocene Formations. They are found at Russeifa, El-Hassa, Salt-Road, and El-Shydieh. However, only deposits at Russeifa and El-Hassa are being used at present. Deposits at Russeifa occur in four exploitable beds, each four to thirteen feet thick, separated by three sterile beds, and contain an average 68/70 percent tricalcium phosphate.[1] Deposits at El-Hassa occur in two beds, the upper of which is five to thirteen feet thick while the lower bed is between seven and thirty feet thick, and has an average tricalcium phosphate content of 75 percent.[2]

PART TWO. PHOSPHATE ROCK WORLD RESERVES

An accurate estimate of world reserves of phosphate rock deposits is difficult to make since their commercial viability depends on the size and geological situation of deposits, their benefication and processing feasibility, their chemical and physical composition, market accessibility, and profit potential. To simplify the matter, phosphate rock reserves are classified in three categories: possible reserves; indicated reserves; and proven reserves.

In the early 1940's, phosphate rock world reserves were estimated at about 26 billion metric tons distributed as follows:[3] 13.5 billion tons or 51.9 percent of total reserves in the United States; 7.6 billion tons or 29.2 percent in Russia; and half of the balance or 9.6 percent in North Africa. By 1957, phosphate rock reserves had nearly doubled (46 billion metric tons). Their distribution had also changed considerably as shown in table I.I. More than half of the reserves were now in North Africa, about one-third (28.9 percent) in the United States, and only 16.3 percent in Russia.

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1. Kingdom of Jordan, Jordan Phosphate Mines Company, Report on Phosphates of Jordan, (Amman: National Press, 1972), p. 2.

2. Ibid., p. 2.

3. See, Appendix I.A.

Recent estimates, however, indicate that the total of known and potential reserves of phosphate rock and apatite is 19,800 million tons of phosphorus, equivalent to approximately 150,000 million tons of marketable phosphate rock.[1]

In view of the present rapid increase in world production of phosphate rock, the rock reserves which are economically viable to exploit under present conditions, might deplete in future. For example, the United States phosphate rock deposits are expected to last for another 500 years.[2] The rate of depletion of phosphate rock reserves, however, should not be a cause for concern since continued prospecting has demonstrated that newly discovered deposits are growing at a faster rate. Such deposits are expected to grow at even faster rates when proper searches for phosphate rock deposits are carried out in South America, Asia and Africa.

TABLE I. I.

Percentage Distribution and Growth of World Reserves of Phosphate Rock

Country	1944	1957	% 1957/1944
United States	51	28.9	(43.3)
Russia	29	16.3	(43.8)
North Africa	14	51.7	269.3
Rest of the World	6.0	3.1	(48.3)
Total	100	100	

Source: Appendices I. A. and I. B.

1. The British Sulphur Corp. Ltd., Phosphate Reserves and the Ecologists, Statistical Supplement No. 58, March 1972, p. 3.

2. J. R. Van Wazer, op. cit., p. 972.

PART THREE. TECHNOLOGY AND DEVELOPMENTS IN WORLD PRODUCTION OF PHOSPHATE ROCK.

A. TECHNOLOGY

The production of phosphate rock is in two stages, firstly the mining of deposits, and secondly, the processing of such deposits.[1] The extent of treatment of the mined phosphate rock, however, depends upon the grade of product demanded in world markets. In some cases, the phosphate rock is sold and used as taken from the ground.

Phosphate rock is obtained by underground and surface mining. The method applied however, depends on how thick the overburden is. By far the greater part of American production uses the surface mining method, whereas in North Africa and Russia underground mining is common. Both production methods are employed in Jordan, but in recent years the importance of underground mining has diminished.

B. DEVELOPMENTS IN WORLD PRODUCTION OF PHOSPHATE ROCK

During the period 1950 to 1975, world production of phosphate rock increased from 20.3 million metric tons to 105 million metric tons, a rise of an annual average of 7.1 percent.[2] During the 1950's world production grew at an average annual rate of 5.6 percent, but between 1960 and 1969 the average annual growth rate rose to 10.6 percent as a result of the implementation of development plans to expand production in most of the main phosphate rock producing countries. The demand for phosphate rock in the mid 1960's was not as high as expected, and therefore there was an over-supply of phosphate rock in world markets during the period 1967 to 1969, a situation which forced some producers, particularly in the United States, to cut down production in an attempt to reduce their increasing stocks. The world demand for phosphate rock, however, improved significantly between 1970

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1. To avoid repetition, detailed analysis on the methods and stages of production is presented in Chapter Six.

2. See Table I.2., Appendix I.C., and Figure I.a.

TABLE I. 2.

Percentage Growth of World Production of Phosphate Rock, 1950-1975

Year	Percentage Change	Year	Percentage Change	Year	Percentage Change
1950	-	1960	-	1970	-
1951	4.9	1961	6.0	1971	3.0
1952	5.4	1962	3.9	1972	7.7
1953	27.7	1963	4.1	1973	9.1
1954	- 12.2	1964	14.8	1974	17.1
1955	- 2.0	1965	42.9	1975	- 10.1
1956	16.3	1966	16.0		
1957	- 4.9	1967	2.3	Total Percentage Change 1970-1975	26.8
1958	7.4	1968	7.9		
1959	7.5	1969	- 2.5		
Total Percentage Change 1950-1959	50.1	Total Percentage Change 1960-1969	95.4	Annual Average 1970-1975	5.4
Annual Average 1950-1959	5.6	Annual Average 1960-1969	10.6		

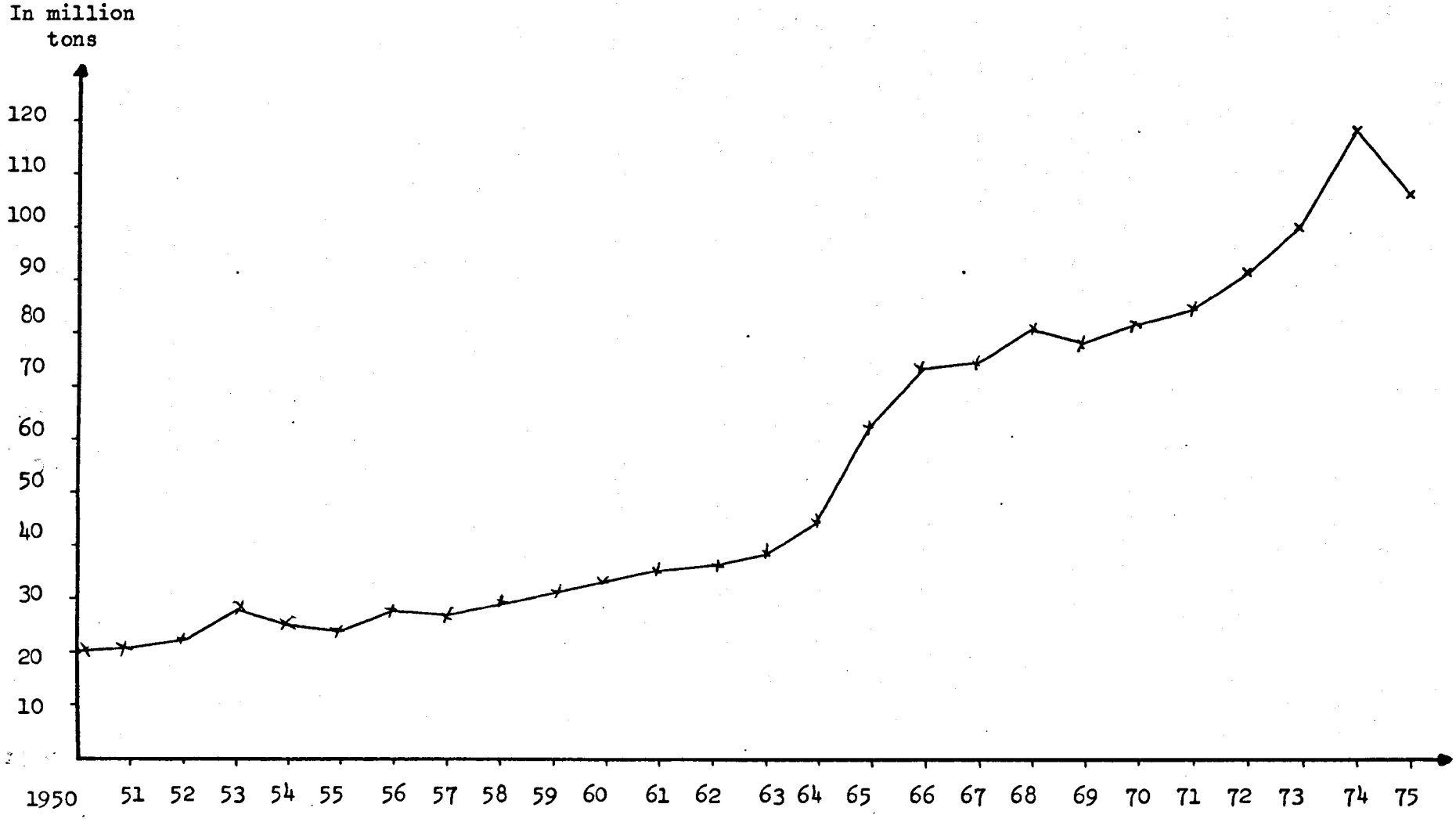
Summary: Total Percentage Change 1950-1975 - 183.2

Annual Average Growth 1950-1975 - 7.1

Source: Appendix I.C.

FIGURE 1.a

World Production of Phosphate Rock, 1950-1975 • x—x—x—x



and 1974 and production grew at an annual average rate of 9.2 percent. However, in 1975, world production dropped by 10.1 percent from 117.1 million tons in 1974 to only 105.3 million tons. This decline in output can be attributed to the fact that producing countries were forced to reduce their production levels because of the significant fall in the world demand for phosphate rock in that year.

The distribution of world production of phosphate rock by continents offers an interesting observation on the relative importance of various regions of the world in phosphate rock production during the period 1965 to 1974. In 1965, Table I. 3 shows that 43.4 percent of world production came from America, 23.0 percent from Europe, and 25.8 percent from Africa, with only the remaining 7.8 percent from Asia (3.7 percent) and Oceania (4.1 percent).

Between 1965 and 1974, America continued to rank first among world producing regions and its production level grew by approximately 54 percent. However, its contribution to world total production of phosphate rock declined by 7.4 percent between 1965 and 1972, and by 10.7 percent between the years 1972 and 1974. Therefore, the overall decline in its contribution was about 17.3 percent over the period 1965 to 1974. Africa, on the other hand, ranked second, accounting for 25.8 percent of world production in 1965, 26.9 percent in 1972, and 26.7 percent in 1974 - an overall growth of 7.1 percent between 1965 and 1974. During the same period, however, the tonnage of phosphate rock production in Africa grew by 92.4 percent. Europe occupied the third position by constituting 23.0 percent, 23.8 percent, and 26.2 percent of world output in the years 1965, 1972 and 1974, respectively. Therefore, its contribution grew at 3.5 percent in the 1965-1972 period, 10.1 percent between 1972 and 1974, and at 13.9 percent over the whole period from 1965 to 1974. The overall growth in its production level during the same period was 111.7 percent. The level of production in Asia grew steadily from 2.3 million metric tons in 1965 to 8.55 million tons in 1974, a rise of

TABLE I. 3.

Percentage Distribution and Growth of Production of Phosphate Rock by Major Areas

	Percentage Contribution To World's Total Production			Growth in Contribution of Area			Growth in Output			Average Annual Growth, 1965-1974 in Production by Area
Area	1965	1972	1974	1972/ 1965	1974/ 1972	1974/ 1965	1972/ 1965	1974/ 1972	1974/ 1965	
America	43.4	40.2	35.9	-7.4	-10.7	-17.3	33.8	14.9	53.8	5.4
Europe	23.0	23.8	26.2	3.5	10.1	13.9	49.5	14.7	111.7	11.2
Africa	25.8	26.9	26.7	4.3	-0.7	3.5	50.6	27.7	92.4	9.2
Oceania	4.1	4.4	3.9	7.3	-11.4	- 4.9	55.0	14.1	76.8	26.7
Asia	3.7	4.7	7.3	27.0	55.3	97.3	83.5	99.9	266.7	7.7
World Total	100.0	100.0	100.0				44.4	28.7	85.9	8.6

Source: Appendix I.D.

266.7 percent. Its contribution to world total production rose by 97.3 percent in that period, from 3.7 percent to 7.3 percent. Oceania, on the other hand, was responsible for production of 2.6 million tons in 1965 or 4.1 percent of world output, but this declined by an annual average of 4.9 percent until, by 1974, production stood at only 3.9 percent of the world total. Nevertheless, during the same period, actual production grew by 76.8 percent.

The distribution of world production of phosphate rock by country reveals that the United States, Russia and Morocco were the largest phosphate producers by far.[1] Together, they provided about 80 percent of world output in 1965 and 77.4 percent in1975. Production in the United States

TABLE I. 4.

Percentage Contribution and Growth in World Production of Phosphate Rock by Main Producing Countries

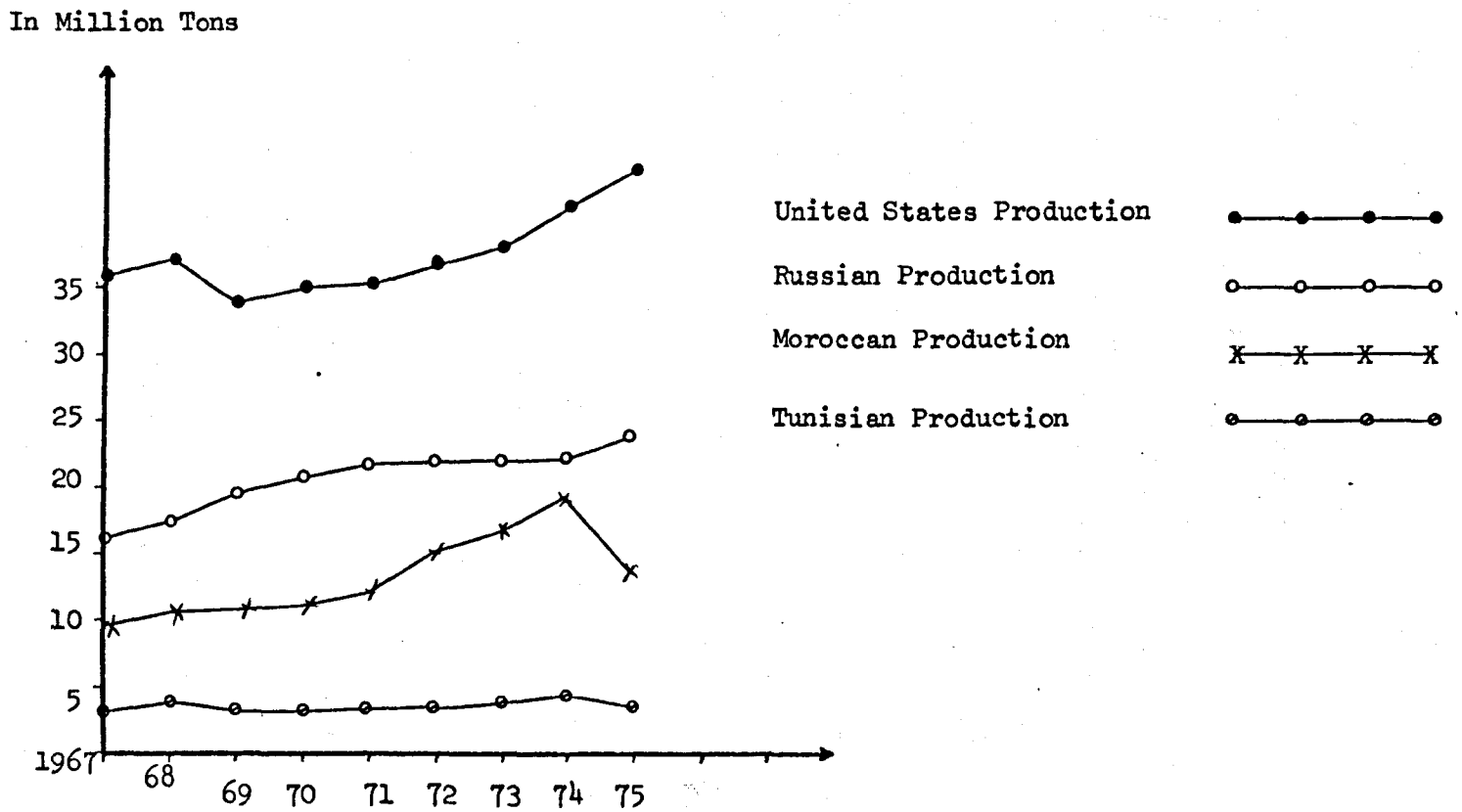
Country	1965	1972	1975	Growth 1975/1965	Growth in Output 1975/1965
U.S.A.	42.4	43.8	41.7	- 1.7	+ 64.4
Russia	21.4	26.0	22.9	+ 7.0	+ 78.5
Morocco	15.6	17.8	12.8	- 17.9	+ 37.4
Tunisia	4.8	4.0	3.3	- 31.3	+ 15.1
Nauru	2.7	3.0	2.4	- 4.1	+ 47.7
Sub-Total	86.9	94.6	83.1		
Other Countries	13.1	5.4	16.9		
Grand Total	100.0	100.0	100.0		

Source: Appendix I.E.

1. See Figure I. b. and Table I.4.

FIGURE I.b

THE MAIN PRODUCING COUNTRIES
OF PHOSPHATE ROCK, 1967-1975.



grew by 64.4 percent between 1965 and 1975, although as a percentage of total output this declined by 1.7 percent from 42.4 percent to 41.7 percent. Over the same period, Morocco's contribution to world output declined by 18 percent, reaching 12.8 percent in 1975. Its production level, however, grew by 37.4 percent. Russia, on the other hand, accounted for 22.9 percent of the world output in 1975, or an increase of 7 percent over its contribution in 1965. Production patterns in Tunisia and Nauru, however, were more erratic although they maintained their positions in the world production tables of phosphate rock. Their output grew by 15.1 percent, and 47.7 percent respectively during the period 1965 to 1975. However, the proportion of world output attributed to them declined by 31.3 percent and 4.1 percent respectively, and in 1975 they stood at 3.3 percent for Tunisia and 2.4 percent for Nauru.

It is possible to obtain valuable by-products from phosphate rock deposits.[1] The two by-products which have received the most attention are fluorine and uranium. Not unexpectedly, interest in uranium has developed since World War II because of the large-scale exploitation of nuclear energy. The uranium content in the commercial phosphate rock from Florida is in the range of 0.1 - 0.4 lb of uranium per ton. Another by-product is vanadium, sometimes called 'the green acid'. Phosphate deposits in western States contain 0.07 percent to 0.4 percent vanadium oxide and about 3 percent fluorine, combined as fluorapatite.[2]

Finally, it should be noted that the control of phosphate rock deposits and consequently the production of phosphate, lies in different hands, depending on the type of government in the producing countries. In the United States phosphate rock deposits are exploited mainly by private domestic companies, although in some cases deposits are in the hands of subsidiaries of foreign companies. In Russia and most of the Middle Eastern countries the production of phosphate rock is undertaken by the governments of those states.

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1. For more information on the by-products that can be produced from phosphate rock deposits, see J. R. Van Wazer, op. cit., pp. 983-985.
2. United States, U.S. Department of Interior, Mineral Facts and Problems, Bulletin 650, (New York: 1970), pp. 1139-1155.

PART FOUR. SUMMARY AND CONCLUSION

(i) Natural resources represent, together with capital, human resources and technology, the principal economic assets. Mankind can only progress by making efficient use of the earth's natural resources.

(ii) Phosphorus is vital to plant growth and is obtained from three principal sources: guano or deposits derived from guano; igneous apatites; and sedimentary deposits.

(iii) Phosphate rock deposits are widespread throughout the world, with the greater part of world reserves lying in North Africa, America and Russia. World reserves are expected to grow substantially in view of the continuous exploration activities in different parts of the world. Reserves, therefore, should last for many decades to come. Nevertheless, periods of excess demand or excess supply could occur depending on the world market situation of phosphate rock and the production levels of producing countries.

(iv) Phosphate rock is obtained by underground or surface mining depending on the depth of the deposits below the surface. The greater part of recovered deposits must be beneficated before being sold in the world market.

(v) Between 1950 and 1975 world production of phosphate rock rose by an annual average rate of 7.1 percent to reach 105.3 million metric tons. The main areas of production are America (the United States), Europe (Russia) and North Africa (Morocco). Production of phosphate rock in Asia, however, is still at a relatively low rate although it has increased substantially since 1950. This clearly indicates an imbalance in the distribution of world phosphate rock production among the regions of the world. This imbalance could be corrected by active international trade and by continued prospecting in Asia and other regions.

(vi) It is possible to obtain important by-products such as uranium, fluorine and vanadium from phosphate rock deposits. Production of these,

however, is very costly, particularly for developing countries such as Morocco and Jordan.

(vii) Finally, phosphate rock deposits and production are either in the hands of local or foreign private companies or operated by governments, depending upon the type of economic and political system.

CHAPTER TWO: WORLD DEMAND FOR PHOSPHATE ROCK

This chapter examines the world demand for phosphate rock. To achieve a better understanding of world demand it is necessary to review the applications and uses of phosphate rock. Later in the chapter an attempt will be made to estimate a demand function for the world industry which will be useful in explaining and forecasting trends in world consumption of phosphate rock.

PART ONE. APPLICATIONS AND USES OF PHOSPHATE ROCK

People constitute the basic raw material with which markets are made, for ultimately, the demand for any given product or service depends upon the aggregate demand of individual consumers.[1] As world population and income increase, the demand for goods and services grows and results in greater derived demand for non-renewable natural resources. This greater demand, however, usually causes a rise in the price of natural resources and therefore induces suppliers to raise their production levels, and, at the same time, motivates buyers to search for lower-priced substitutes. In growing economies, producers can benefit from the economies of scale by producing larger quantities at lower costs due to advances in technology and in the means of production. Nevertheless, this usually leads to scarcity of the earth's non-renewable natural resources.

The conditions affecting the demand for raw materials differ from those governing the demand for consumer goods because the users of raw materials are mainly industrial concerns that usually buy in organized markets according to exact specifications.[2]

Phosphorus is the essential constituent of phosphate rock. It is a vital nutrient of plants and performs various biochemical functions in all organisms.

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1. M. J. Baker, Marketing: An Introductory Text, (London: Macmillan and Company Ltd., 1971), p. 74.

2. Clare Wright Barker and Melvin Anslen, Modern Marketing, (New York: McGraw-Hill Book Company Inc., 1939), pp. 56-57.

'There can be no life - either plant or animal - without phosphorus. Every living cell of the plant body or animal structure and all bacterial cells contain phosphorus, which is absolutely essential for their existence and life process. Plants receive all their phosphorus directly from the soil, but animals get theirs by eating either plant or animal tissue. Hence, soil is the ultimate source of all phosphoric acid in organic life.' 1

Phosphorus in its combined form and elemental state has diverse agricultural and industrial uses. About 85 percent of world production of phosphate rock is consumed in the manufacture of phosphate fertilizers and their variants.[2] Therefore, the world phosphate rock industry is very dependent upon demand by the fertilizer industry. Of the several kinds of phosphatic fertilizers produced, the one with the fastest growing demand is the triple or concentrated superphosphate. Other phosphatic fertilizer materials include: monoammonium phosphate, diammonium phosphate, ammonium phosphate nitrate, ammonium phosphate sulphate, ammoniated super phosphate, calcium metaphosphate, magnesium ammonium phosphate, finely ground phosphate rock, and calcined phosphate rock.

The largest industrial use of phosphorus is in detergents. Figure II. a shows that in 1968, 7 percent of all phosphate rock consumed in the United States went into the manufacture of detergents and cleaning compounds. Phosphorus is also used in plating and polishing, or the surface treatment of metals. In the United States, 3 percent of the total phosphate rock consumed in 1968 was used in this way. Another 3 percent was used for animal and fowl feed supplement. Table II. 1 summarises the other industrial uses for phosphorus ammounting to 11 percent of total consumption of phosphate rock in the United States in 1968.

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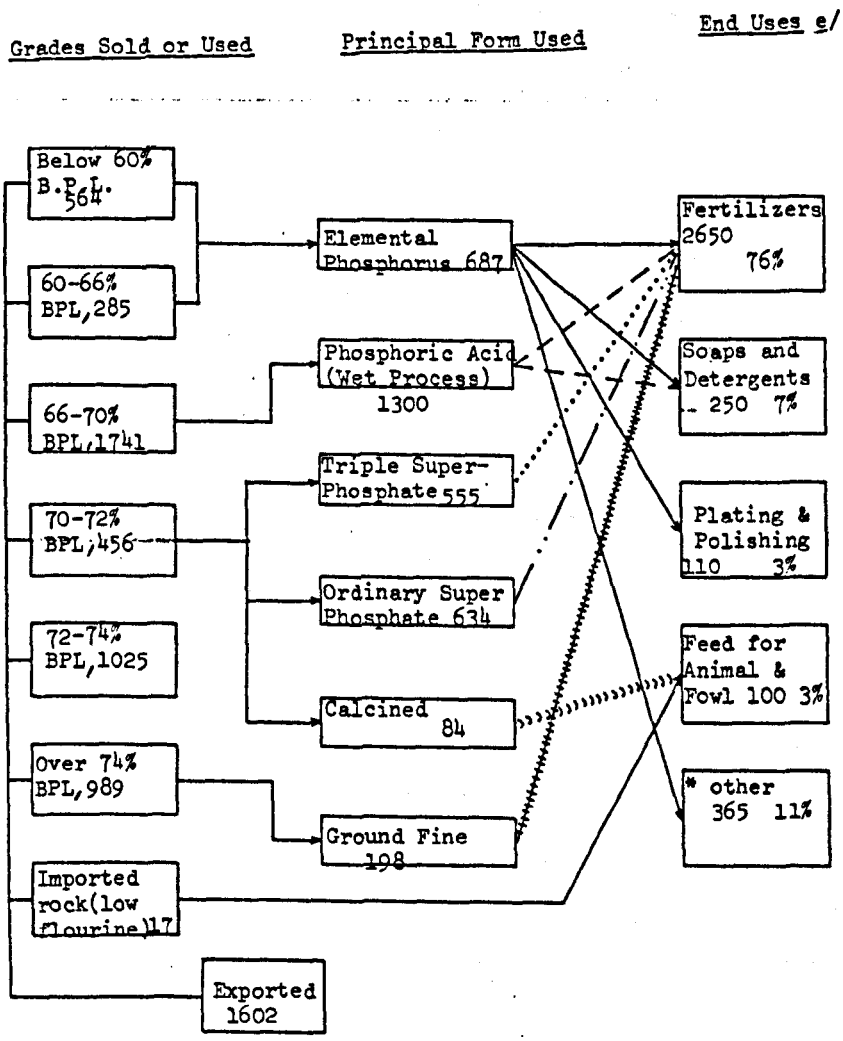
1. Paul M. Gary, The U.S. Phosphate Rock Industry and World Trade in Phosphate Rock, M.BA Thesis, University of Pennsylvania, 1957, p. 255

2. Robertson Research International Ltd., A Market Appraisal of Rock Phosphates, (London: 1974), p. 20.

FIGURE II.a.

MATERIAL FORMS FLOW FOR PHOSPHORUS, 1968.



e/ estimated
B.P.L. Bone Phosphate of Lime
Unit: Thousand Short Tons (P) Content
* Other: includes all items presented in table II.2

Source: U.S. Department of Interior and Mines, Mineral Facts and Problems, Bulletin 650, (New York: Government Publication 1970), p.1147.

TABLE II. 1.

Undistributed End-Use Category for Phosphate Rock

Rat Poisons	Bone China
Soft Drinks	Water Softeners
Matches	Photographic Film and Chemicals
Fire Retardants	Glass
Toothpaste	Insecticides
Dental Cement	Sugar Processing
Plastics	Pharmaceuticals
Shaving Cream	Oil Refining
Gasoline Additive	Silk Fabrics
Baking Powder	Military Uses

Source: United States Department of Interior and Mines, Mineral Facts and Problems, Bulletin 650, (New York: Government Publications, 1970), p. 1146.

PART TWO. PRESENT WORLD CONSUMPTION PATTERN OF PHOSPHATE ROCK

World consumption of phosphate rock, like all non-renewable natural resources, has been increasing exponentially over the last decade. This pattern of growth is expected to continue as long as world population and the demand for chemical fertilizers and industrial products continue to grow. World consumption of phosphate rock grew from 55 million tons in 1964 to 113 million tons in 1974, a rise of 7.6 percent per year.[1]

The distribution pattern by geographical area reveals, however, that America consumed 34.1 percent of total world consumption of phosphate rock in 1970 and 34.5 percent in 1974, a rise of 1.2 percent.[2] Europe, however, accounted for 47.5 percent and 46.3 percent of total world consumption in 1970 and 1974 respectively, or a decline of 2.5 percent. Therefore, America and Europe together consumed 81.6 percent and 80.9 percent of total world consumption in 1970 and 1974 respectively.

This surely correlates with the fact that America and Europe are the major crop-producing zones. The consumption of phosphate rock by Africa, however, represented 3.6 percent in 1970 and 4.2 percent in 1974 of the world total, a rise of 16.7 percent. Asia, on the other hand, consumed 10.4 percent and 11.3 percent of the world total in 1970 and 1974 respectively, a rise of 8.7 percent. Its consumption, therefore, represented approximately one-half of the consumption of Western Europe. In addition, Oceania accounted for 4.4 percent and 3.7 percent of the world total in 1970 and 1974 respectively (a decline of 15.9 percent). This pattern of consumption by geographical areas will probably remain similar in the short-run, but in the longer term, changes will probably develop as demand for phosphatic fertilizers and industrial products increases in nations that

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1. See, Table II. 2. and Figure II. b.

2. See, Table II. 3. and Appendix II. A.

TABLE II. 2.

Percentage Growth of World Consumption of Phosphate Rock, 1964-1974

Year	Consumption in million tons	Percentage Change
1964	55	-
1965	60	+ 9.1
1966	70	+16.7
1967	72	+ 2.9
1968	75	+ 4.2
1969	77	+ 2.7
1970	78	+ 1.3
1971	84	+ 7.7
1972	92	+ 9.5
1973	101	+ 9.8
1974	113	+11.9
Total Change between 1964 and 1974	79.7	+75.8

Average annual growth between 1964 and 1974 = 7.6 percent

Source: International Superphosphate Manufacturers Association (ISMA), Annual Phosphate Rock Statistics, 1964-1974, (London).

TABLE II. 3.

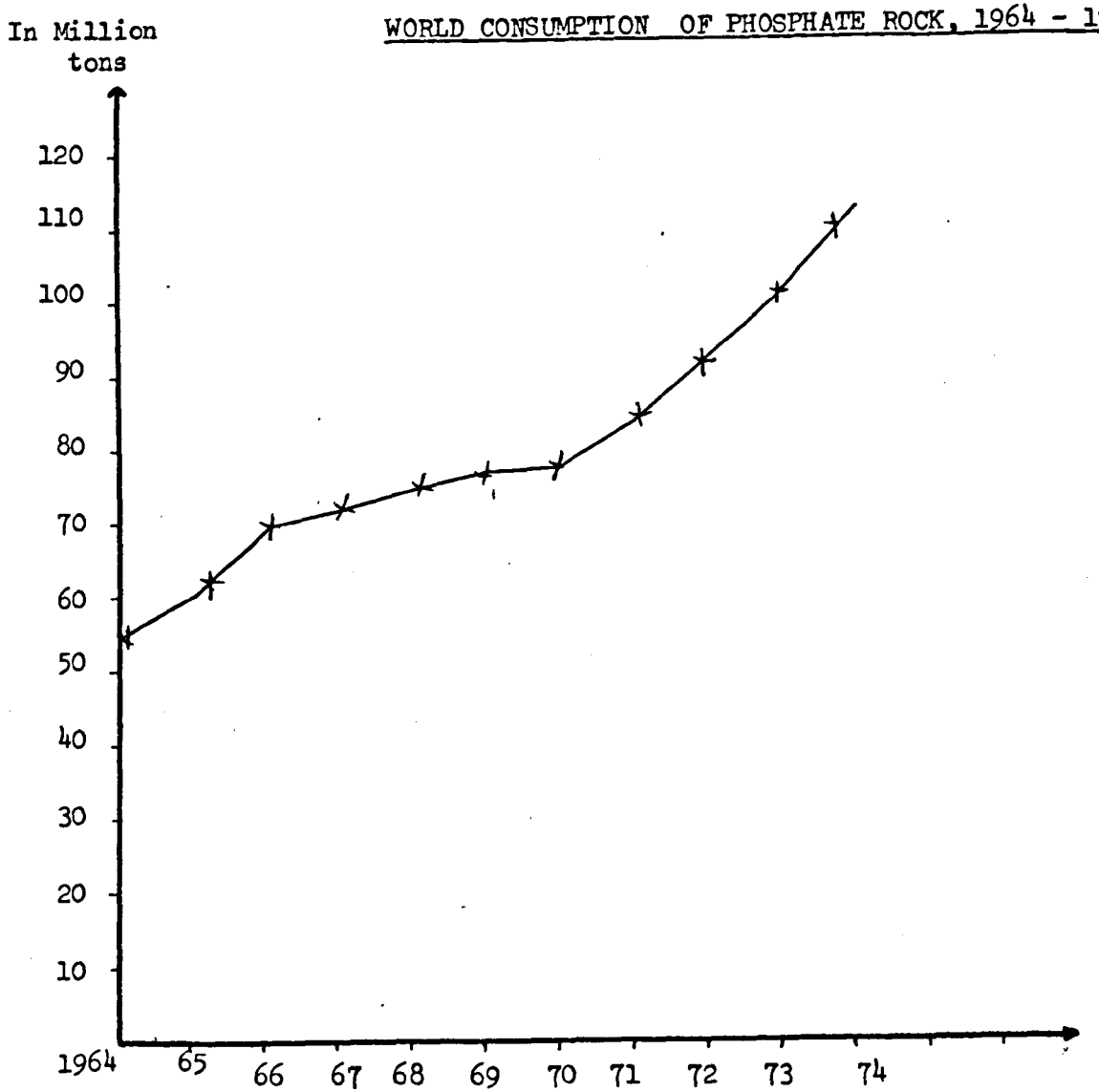
Percentage Distribution and Growth of World Consumption of Phosphate Rock By Geographical Areas, 1970-1974

Area	1970	1971	1972	1973	1974	1974/1970
West Europe	22.9	22.2	22.8	22.8	22.6	- 1.3
East Europe	24.6	25.2	23.9	23.2	23.7	- 3.7
Europe	47.5	47.4	46.7	46.0	46.3	- 2.5
Africa	3.6	3.7	4.3	4.4	4.2	+ 6.7
North America	32.0	31.7	32.2	31.3	31.1	- 2.8
Central America	1.0	1.2	1.3	1.5	1.5	+ 50
South America	1.1	1.3	1.5	1.5	1.9	+ 72.7
America	34.1	34.2	35.0	34.3	34.5	+ 1.2
Asia	10.4	10.8	11.0	11.1	11.3	+ 8.7
Oceania	4.4	3.9	3.0	4.2	3.7	+ 15.9
World Total	100.0	100.0	100.0	100.0	100.0	

Source: Appendix II. A.

FIGURE II.b

WORLD CONSUMPTION OF PHOSPHATE ROCK, 1964 - 1974.X-X-X



are now relatively small consumers of phosphate rock.

The distribution pattern of world consumption by country, on the other hand, reveals that the United States consumed an annual average of 28.7 percent of the total world consumption during the period 1970 to 1974.[1] However, its share declined by 4.8 percent during the same period, although actual consumption increased by 37.7 percent from 22.8 million tons to 31.5 million tons. In Western Europe, France consumed an annual average of 4.6 percent of the total world consumption whereas Belgium, West Germany, Italy, Spain, Britain and the Netherlands each consumed an annual average of between 2 and 4 percent of the world total between 1970 and 1974.

During the same period, in Eastern Europe, Russia consumed an annual average of 15 percent of the world total, and Poland, Czechoslovakia and East Germany each consumed between one and 3 percent annually. Consumption in Africa was relatively low: South Africa consumed an annual average of 1.5 percent and Tunisia an annual average of 1.1 percent of the world total during the same period.

The consumption in Asia, however, was characterized by a yearly average of 3.9 percent in China, 1.1 percent in India and 3.4 percent in Japan during the period, whereas in Oceania consumption was mainly in Australia with a yearly average of 2.7 percent of the world total, and New Zealand with 1.2 percent.

It is noticeable that consumption was increasing in developing countries, whereas the relative share of world consumption of developed and centrally-planned economies decreased. This is partially explained by the increase in demand for phosphatic fertilizers by developing countries which is mainly being met by exports from developed and centrally-planned economies (Table II. 5.). However, among the important factors constraining the development of indigenous fertilizer industries in developing countries

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1. See, Table II. 4.

TABLE II. 4.

Percentage Distribution of World Consumption of Phosphate Rock By Main Consuming Countries, 1970-1974

Country	1970	1971	1972	1973	1974	*1	**2
Belgium	2.4	2.4	2.6	2.4	2.2	2.4	- 8.3
France	4.7	4.5	4.5	4.9	4.2	4.6	- 10.6
W. Germany	3.4	3.4	3.3	3.0	3.0	3.2	- 11.8
Italy	2.6	2.3	2.3	2.0	1.8	2.2	- 30.8
Netherlands	1.8	1.9	2.0	2.2	2.0	2.0	+ 11.1
Spain	1.8	1.9	2.2	2.2	2.5	2.1	+ 38.9
Britain	2.1	2.0	1.9	2.0	1.8	2.0	- 14.3
U.S.S.R.	15.8	16.2	14.7	14.4	14.7	15.2	- 7.0
Poland	2.6	2.8	2.9	2.5	2.7	2.7	+ 3.9
S. Africa	1.5	1.4	1.6	1.6	1.4	1.5	- 0.9
Tunisia	0.9	0.9	1.1	1.2	1.2	1.1	+ 33.3
U.S.A.	29.3	28.8	29.3	28.2	27.9	28.7	- 4.8
Mexico	1.0	1.1	1.3	1.5	1.5	1.3	+ 50
Brazil	1.0	1.0	1.2	1.1	1.4	1.2	+ 40
China	3.6	4.0	4.1	4.2	3.7	3.9	+ 2.8
Japan	3.7	3.3	3.2	3.3	3.5	3.4	- 5.4
Australia	3.0	2.6	1.9	3.0	2.8	2.7	- 6.7
New Zealand	1.3	1.3	1.1	1.3	1.0	1.2	- 23.1
E. Germany	1.7	1.7	1.5	1.4	1.3	1.5	- 23.5
India	1.0	1.0	1.2	1.0	1.2	1.1	+ 20
Czechoslavakia	1.3	1.3	1.2	1.0	1.1	1.2	- 15.4
Total	86.5	85.8	85.1	84.4	82.9		

* Average ratio of a country's consumption to world consumption during the period 1970 to 1974.

** Percentage change during the period 1970 to 1974.

Source: Appendix II. B.

TABLE II. 5.

Percentage Distribution and Growth of World Consumption of Phosphatic Fertilizers

	1971/1972 Consumption	1972/1973 Consumption	Percentage Change
Africa	3.1	3.1	
N. & C. America	23.7	23.5	
S. America	3.4	4.3	
Asia	14.7	14.8	
Europe	38.3	36.8	
Oceania	5.3	5.4	
U.S.S.R.	11.5	12.1	
World Total	100.0	100.0	
Developed Market Economies	60.4	58.7	- 2.82
N. America	22.5	22.1	
W. Europe	28.0	26.6	
Oceania	5.3	5.4	
Other	4.6	4.6	
Developing Economies	12.6	13.7	+ 8.7
Africa	1.3	1.3	
Latin America	4.7	5.6	
Near East	1.7	2.0	
Far East	4.9	4.7	
Other	-	0.1	
Centrally-Planned Economies	27.0	27.6	+ 2.2
Asia	5.3	5.2	
Europe & U.S.S.R.	21.7	22.4	

Source: Appendix II. C.

are: the size of local markets; the lack of necessary raw materials for the manufacture of fertilizers; the size of capital investment and the relatively high level of technology required; and finally, the competition from other sources of supply.

PART THREE. ESTIMATION OF A DEMAND FUNCTION FOR PHOSPHATE ROCK

A. THEORETICAL FRAMEWORK

Throughout the analysis in this section, the relatively well developed field of demand theory is utilized. Demand theory in general attempts to explain the behaviour of consumers in the market place, and is particularly concerned with the process by which consumers make choices from a range of available commodities in the market at a given time. Classical or neo-classical demand theory begins with the notion of a utility function which makes an individual's satisfaction depend upon the set of goods that he consumes subject to prices established in the market place, and a fixed income.[1]

The main concern of this section is the world demand for phosphate rock, as exemplified by the world consumption behaviour during the years 1962 to 1974, and the determinants of such demand.

This study attempts to test the effect of the following factors on world demand for phosphate rock.[2]

(a) The average price per ton of phosphate rock: economic theory postulates that the direction of the substitution effect is always negative. If income is continuously adjusted so that the consumer realises the same level

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1. For a detailed analysis about demand theory see, H. Wold and J. L. Jureen, Demand Analysis,(New York: John Wiley, 1953); L. R. Klein, An Introduction to Econometrics, (Englewood Cliffs: Prentice Hall Inc., 1962); R.H. Leftwich, The Price System and Resource Allocation,(New York: Holt, Renihart and Winston, 1961); G.J. Stigler, The Theory of Price,(New York: Macmillan and Company Ltd., 1952); W.J. Baumal, Economic Theory and Operations Analysis (Englewood Cliffs: Prentice Hall Inc., 1961); and J.M. Henderson and R.E. Quandt, Microeconomic Theory, (New York: McGraw-Hill Company Ltd., 1958).

2. This analysis tests the effect of the above factors on the world demand for phosphate rock when they are lagging one year behind. For more details on the distributed lags and their causes, see, L.M. Koyck, Distributed Lags and Investment Analysis, (Amsterdam: North- Holland Publishing Company, 1954), pp. 4-15 and 40-49.

of utility, then a price rise will be associated with a decrease in consumption. Hence, the association between price and quantity is negative, the usual form of a demand curve. However, since in practice, sets of data on prices and quantities are collected from market behaviour over a period of time, it is not expected that all other things will remain equal. Therefore, the simple inverse relation between price and quantity may not exist in the data as collected.[1]

Moderate changes in the average price of phosphate rock per ton are expected to have a slight effect on the world demand for phosphate rock, since such a demand is essentially a derived one and the difference between the average price per ton of phosphatic fertilizers and phosphate rock is very high. Any substantial change, however, could seriously affect the world demand for phosphate rock. In 1973/1974 phosphate rock prices soared and led to higher demand levels. This can be explained by the behaviour of the main phosphate rock consumers. They continued to demand more phosphate rock at a time when prices were soaring, a clear example of speculative demand.

(b) The average price of phosphate fertilizers per ton: the increasing demand for phosphatic fertilizers and the expected increase in their prices make the effect of this variable on the demand for phosphate rock positive. This is because producers of phosphatic fertilizers will have to increase their output in order to meet the increasing demand for phosphatic fertilizers for which there is no substitute. Therefore, such producers will prefer to buy phosphate rock at the increased price which is expected to increase more in the future.

(c) The average price per ton of possible substitutes for phosphatic fertilizers, namely nitrogen and potash fertilizers: In theory, if the demand for phosphatic fertilizers decreases as the price of nitrogen of

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1. For discussions concerning the problems associated with time series, see. Klein, op.cit., pp.52-74.

or potash fertilizer decreases, then nitrogen or potash fertilizers are substitutes for phosphatic fertilizers. Therefore, given a price decrease in nitrogen or potash fertilizers, an increase in consumption of these can be expected. However, if such an increase in consumption is countered by a decrease in the consumption of phosphatic fertilizers, then phosphatic fertilizers and nitrogen or potash fertilizers are substitutes. But if the quantity of phosphatic fertilizers demanded increase as the price of nitrogen or potash fertilizers increases, then phosphatic fertilizers and nitrogen or potash fertilizers are complimentary. The analysis will test for substitution among the three fertilizers although the discussion presented in Chapter One affirmed that there is no substitute for phosphorus as a nutrient because benefits derived from using phosphate fertilizers differ from those gained from using other chemical fertilizers. If there is no substitution among the chemical fertilizers, the prices of nitrogen and potash fertilizer will not be determinants of world demand for phosphate rock.

(d) World Income: Theoretically, one cannot be certain about the direction of the income effect. It may be either positive or negative depending on whether the product in question is inferior or superior. In the real world, however, most products are found to be superior, thus the substitution effect is usually more intense than the income effect. In the case of the world demand for phosphate rock, it is expected that higher world income, as exemplified by an index number of world domestic product (1963= 100), will lead to higher world demand for phosphate rock in order to improve the yield of world agricultural produce to cope with the increasing world population.

(e) Finally, the world demand for phosphate rock lagging one year behind: This factor is expected to affect the demand for phosphate rock in the next period positively.

Generally speaking, these determinants can be fitted into a demand function in the following manner:

$$Y_t = F(X_1, X_2, X_3, X_4, X_5, X_6)$$

where Y_t is the total world consumption of phosphate rock in tons at time (t). X_1 and X_1^- are the average prices per ton of phosphate rock, adjusted for inflation, at time (t) and (t-1) respectively. X_2 and X_2^- are the average prices per ton of phosphatic fertilizers, adjusted for inflation, at time (t) and (t-1). X_3 and X_3^- are the average prices per ton of nitrogen fertilizers, adjusted for inflation, at time (t) and (t-1). X_4 and X_4^- are the average prices per ton of potash fertilizers, adjusted for inflation, at time (t) and (t-1). X_5 and X_5^- represent the world income (as index numbers, 1963=100) at time (t) and (t-1). Finally, X_6 is the world consumption of phosphate rock in tons at time (t-1).

The estimated functions, however, can take different mathematical forms such as linear or logarithmic. Nevertheless, the most appropriate function and its form depends on the empirical results derived from the application of multiple regression analysis under the different assumptions. Moreover, the most important information that could be derived from the best estimated function is the effect of a change in the value of one or more of the independent variables on the dependent variable. The most appropriate measure of such responsiveness, however, is the price and income elasticities of demand for a certain commodity. The price elasticity of a commodity is defined as the negative of the percentage change in quantity demanded, relative to the percentage change in the price, whereas the income elasticity refers to the percentage change in the quantity demanded relative to the percentage change in income.[1] Price and

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1. Milton H. Spencer, Managerial Economics, (Chicago : Richard D. Irwin Inc., 1968), pp. 124-125.

income elasticities are the measures associated with the Slutsky equation:[1]

$$\frac{d\,Qx}{d\,Px} = \left(\frac{d\,Qx}{d\,Px}\right)_{\text{constant}} - Qx\left(\frac{dQx}{dY}\right)_{\text{prices = constant}}$$

where the left-hand portion $\left(\frac{dQx}{dPx}\right)$, indicates the rate of change of consumption of product (x) with respect to changes in its own price, (Px), while everything else is held constant. This rate of change is composed of two parts. The $(dQx/dPx)_u$ = constant, represents the change in consumption of (x) due to the substitution effect, while $- Q_x(dQx/dY)$ prices= constant, represents the change in consumption of (x) due to the income effect.

The partial elasticity of demand for product Qx with respect to its own price, called the price elasticity of demand, is:

$$N_{xx} = \frac{d\,Qx}{d\,Px} \times \frac{Px}{Qx} = \frac{d(\log Qx)}{d(\log Px)}$$

Similarly, the partial derivatives with respect to alternative prices and income can be analysed in terms of elasticities. Thus, a cross elasticity of demand would be:[2]

$$N_{xy} = \frac{d\,Qx}{d\,Py} \times \frac{Py}{Qx} = \frac{d(\log Qx)}{d(\log Py)}$$

where (NXY) represents the rate of change of demand for (Qx) with respect to a change in the price of (Py). Whether products (x) and (y) are substitutes or complements depends upon the sign associated with the derivative or the elasticity measure. The income elasticity of demand would follow a similar formulation in which the demand for product (x) would be d(log Qx/d (log Y) which is usually positive.[3]

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1. See, Henderson and Quandt, op. cit., pp. 24-26.

2. For discussions on cross effects, see, Henderson and Quandt, Ibid., pp. 29-30 and Leftwich, op. cit., pp. 64-66 and 74-76.

3. For a detailed analysis of elasticity concept and its characteristics, see, Baumol, op. cit., pp. 140-148, R.G.D. Allen, Mathematical Analysis for Economists, (New York: St. Martin's Press, 1960), pp. 251-264, and John Perrow, Economics, (London: University Tutoria Press Ltd., 1971), pp. 27-33.

If one estimates elasticity parameters in terms of a linear function such as:

$$Y_t = A + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 \ldots \quad (1)$$

or $$Q_t = A\ (x_1)^{b1}\ (x_2)^{b2} \ \ldots \ (x_6)^{b6} \ \ldots\ . \quad (2)$$

then the elasticity measure will not be invariant, but will vary along the function. Alternatively, estimation of a logarithmic function such as equation (2a):[1]

$$\log Y_t = \log A + b_1 \log x_1 + \ldots + b_6 \log x_6 \ \ldots \quad (2a)$$

will yield elasticity measures of the constant variety such that they will be invariant along the function.

B. STATISTICAL ANALYSIS

The tabulation of the data is presented in the Appendix.[2] However, it is important at this stage of the study to indicate the limitations of the data used in the analysis which covers only the period between 1963 and 1974. Data on world consumption of phosphate rock, phosphatic fertilizers, nitrogen and potash fertilizers was obtained from the United Nations Production Yearbooks. The prices of fertilizers were obtained from the same source by finding the weighted average prices paid by farmers in the main consuming countries, representing about 80 percent of world consumption of chemical fertilizers. The weighted average prices were deflated by the average wholesale price indices of the main consuming countries to account for inflation.[3] Data on phosphate rock prices was obtained by taking the average American and Moroccan prices (adjusted for the average wholesale price indices in those two countries) to represent

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1. Equation (2a) is a simple logarithmic transformation to a linear function. That is, a transformation of equation (2).

2. See, Appendix II. D. and Appendix II. E.

3. The average weighted price was also computed for the chemical fertilizers and was used in the analysis.

world prices, since other producing countries tend to follow the pricing policies of these two main producers. The Index Number of world domestic product is taken to represent the world adjusted income. The base year was taken as 1963=100.

All data obtained was then investigated and considered, using the multiple regression technique. The statistical results are recorded in Tables II. 6 and II. 7. These results were selected from the many different trials that yielded a number of models of world demand for phosphate rock.[1] Efforts were made to avoid the problems related to the implementation of multiple regression techniques.[2]

There is a formula that can be used to estimate whether nitrogen and potash fertilizers are substitutes for phosphatic fertilizers. This formula uses the elasticity of substitution which measures the extent to which any two goods can be substituted. It refers to the relative mix or trade-off between competitive goods and is denoted by:

$$N_s = \frac{d(Q_1/Q_2)}{d(P_1/P_2)} \times \frac{P_1/P_2}{Q_1/Q_2} = \frac{d\ (\log Q_1/Q_2)}{d\ (\log P_1/P_2)}$$

where Q_1 and Q_2 are the quantities and P_1 and P_2 are the prices of the two goods demanded. In terms of equations with a constant elasticity measure, we take a linear logarithmic form as:

$$\log (Q_1/Q_2) = \log A_1 + b \log (P_1/P_2) \quad \ldots\ldots \quad (3)$$

and

$$\log (Q_1/Q_3) = \log A_2 + c \log (P_1/P_3) \quad \ldots\ldots \quad (4)$$

where Q_1 stands for world consumption of phosphatic fertilizers in tons; Q_2 represents world consumption of nitrogen fertilizers; and Q_3 represents world consumption of potash fertilizer. P_1, P_2 and P_3 respectively stand

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1. See, Appendix II. F.

2. For discussions on the problems related to multiple regression analysis, see, Erwine Nemmers and John H. Myerr, Business Research, (New York: McGraw-Hill Book Company, 1966), pp. 165-172 and R.E. Beals, Statistics for Economists, (Chicago: Rand McNally & Company, 1972), chapters 9-12.

TABLE II. 6.

Estimates of the Demand Equations 5 and 6*

	Coefficient	Estimate	St. Error	Estimate	St. Error
Intercept	a_t	+ 26.1814		+ 18.3674	
Income	x_1	+ 0.4480**	0.09	+ 0.4193**	0.07
Price of rock	x_2	- 1.7093	0.99	- 2.1101**	0.73
Price of phosphatic fertilizers	x_3	+ 0.4817**	0.14	+ 0.4981**	0.13
Price of Nitrogen fertilizers	x_4	- 0.2793**	0.09	- 0.2796**	0.08
Price of Potash fertilizers	x_5	- 0.0760	0.12		
	R^2	0.991		0.99	
	D/W	2.17		2.10	

* Equations 5 and 6 are static models. Equation 6 disregards the average price per ton of potash fertilizers as a determinant of world demand for phosphate rock.

** Significant at 0.01 level.

Source: Computer runs according to data in Appendix II. D and Appendix II. E.

TABLE II. 7.

Estimates of the Demand Equations 7 and 8

	Coefficient	Estimate	St. Error	Estimate	St. Error
Intercept	a_t	+ 13.0797		+ 12.7144	
Income	x_1	+ 0.3033	0.35	+ 0.2999*	0.17
Price of rock	x_2	- 1.7022*	1.07	- 1.7067**	0.91
Price of Phosphatic fertilizer	x_3	+ 0.4034*	0.23	+ 0.4019***	0.18
Price of Nitrogen fertilizer	x_4	- 0.2153	0.18	- 0.2139**	0.12
Price of Potash fertilizer	x_5	- 0.0025	0.22		
Consumption at t - 1	x_6	+ 0.2417	0.56	+ 0.2567*	0.31
	R^2	0.991		0.991	
	D/W	2.41		2.41	

* Equations 7 and 8 are dynamic models. Equation 8 disregards the average price per ton of potash fertilizers as a determinant of world demand for phosphate rock.

** significant at 0.1 level.

*** significant at 0.05 level.

Source: Computer runs based on data in Appendix II. D and Appendix II. E.

for the weighted average prices per ton of the three chemical fertilizers. b and c represent the elasticities of substitution which refer to the proportional change in the ratio of two quantities with respect to a unit change in the ratio of their respective prices. The results of estimating the equations above are:[1]

$$(Q_1/Q_2)_t = -0.541 - 0.39\,(P_1/P_2)_t \quad \ldots\ldots \quad (3a)$$

$$(Q_1/Q_3)_t = +0.260 - 0.14\,(P_1/P_3)_t \quad \ldots\ldots \quad (4a)$$

TABLE II. 8.

Estimates of Equations 3a and 4a

	Coefficient	Estimate	St. Error	Coefficient	Estimate	St.Error
Intercept	a_{t1}	- 0.541		a_{t2}	+ 0.26	
P_1/P_2	x_1	- 0.39*	0.15	$P_1/P_3 = x_2$	- 0.14*	0.05
	R^2	0.41			0.47	

* Significant at the 0.05 level.

Though the coefficients of both equations are statistically significant, the overall fit for both functions does not appear to be particularly good. The elasticity estimate for equation (3a) (- 0.39) indicates that phosphate fertilizers and nitrogen fertilizers are weak substitutes for one another. That is, given a small percentage increase in relative prices (say 1 percent) the result is a 39 percent decrease in relative consumption, and therefore composition of market share. On the other hand, the estimate of elasticity of equation (4a) indicates that phosphatic fertilizer and potash fertilizer are very weak substitutes for one another. A one percent

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1. See, Table II. 8. and appendices II. D. and II. E.

increase in relative prices results in a 14 percent decrease in relative consumption.

Therefore, we can safely eliminate the price of potash fertilizer as a determinant of world demand for phosphate rock. In the static models no lagging variables were included, whereas in the dynamic models the demand or consumption of phosphate rock lagging behind one period was considered to influence the demand or consumption of phosphate rock in the subsequent period. Therefore, the static demand functions can be presented as:

$$(5)\quad Y = +26.1814 + \underset{(0.09)}{0.4480}x_1 - \underset{(0.99)}{1.7093}x_2 + \underset{(0.14)}{0.4817}x_3 - \underset{(0.09)}{0.2793}x_4 - \underset{(0.12)}{0.076}x_5$$

and

$$(6)\quad Y = +18.3674 + \underset{(0.07)}{0.4193}x_1 - \underset{(0.73)}{2.1101}x_2 + \underset{(0.13)}{0.4981}x_3 - \underset{(0.08)}{0.2796}x_4$$

where:

x_1 stands for world income as an index number.

x_2 stands for phosphate rock prices per ton, adjusted for inflation.

x_3 stands for phosphatic fertilizer prices per ton, adjusted for inflation.

x_4 represents the price per ton of nitrogen fertilizer, adjusted for inflation

x_5 represents the prices per ton of potash fertilizer, adjusted for inflation.

On the other hand, the dynamic demand models are presented as:

$$(7)\quad Y = +13.0797 + \underset{(0.35)}{0.3033}x_1 - \underset{(0.07)}{1.7022}x_2 + \underset{(0.23)}{0.4034}x_3 - \underset{(0.18)}{0.2153}x_4 - \underset{(0.22)}{0.0025}x_5 + \underset{(0.56)}{0.2417}x_6$$

$$(8)\quad Y = 12.7144 + \underset{(0.17)}{0.299}x_1 - \underset{(0.91)}{1.7067}x_2 + \underset{(0.18)}{0.4019}x_3 - \underset{(0.12)}{0.2139}x_4 + \underset{(0.31)}{0.2567}x_6$$

where x_1, x_2, x_3, x_4, and x_5 are as defined above, and x_6 represents the consumption in tons of phosphate rock in the previous year.

C. INTERPRETATION OF STATISTICAL RESULTS

The analysis on the estimated functions will only include interpreting the statistical results of equations (6 and 8). However, the interpretations of other functions follow the same line of analysis.

The coefficients of determination, (R^2), for equations (6 and 8) are significantly different from zero. That is, the hypothesis that each of the coefficients in both equations is equal to zero must be rejected since the F-ratios for regression are 465 and 496 for equations (6 and 8) respectively. The critical value of F at the 0.01 level, however, is only $F_{0.01} = 8.02$.[1] Each regression equation, therefore, explains a large part of the variation in the quantity demanded for phosphate rock (99 percent for equation (6) and 99.1 percent for equation (8)).

As for equation (6), the variables (x_1, x_2, x_3 and x_4) appear to be important explanatory variables. The marginal response of world demand for phosphate rock to a unit change in the average price per ton of phosphate rock is negative. Hence, a one dollar increase in the price of phosphate rock is expected to cause a 2.11 million ton decrease in the demand for phosphate rock. Therefore, the world demand for phosphate rock with respect to phosphate rock prices is elastic. On the other hand, an increase of one percent of the index number of world income is expected to result in an increase of 0.42 million tons in the world demand for phosphate rock. The effect of an increase in the average price of phosphatic fertilizers on world demand for phosphate rock is positive. A one dollar increase in the average price of phosphatic fertilizers is expected to cause an increase of 0.5 million tons in the demand for phosphate rock.

Finally, a one dollar increase in the average price of nitrogen fertilizers is expected to result in a 0.3 million ton decrease in the

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1. For discussions on F distribution and the method of computation, see, Ralph E. Beals, Statistics for Economists, (Chicago: Rand McNally and Company, 1972), pp. 274-276, 398-399.

demand for phosphate rock. Hence, nitrogen fertilizers are not substitutes for phosphatic fertilizers, since the decrease in the demand for one is not accounted for by an increase in demand for the other. It is also noticed that the algebraic signs of the parameters estimated are as expected. Moreover, the estimates are significant at the 0.05 level since their t-values are greater than the critical t-value, $t_{0.05}=2.36$. Thus the null hypothesis that each of these parameters is zero is rejected.[1]

With respect to equation (8), the signs of the parameters estimated continued to be as expected, but their t-values suggest that they are significant at the 0.1 level. A one dollar increase in the average price per ton of phosphate rock is expected to decrease the world demand for phosphate rock by 1.7 million tons. However, a similar increase in the average price per ton of phosphatic fertilizers and nitrogen fertilizers is expected to cause an increase of 0.4 million tons in world demand for phosphate rock and a decrease of 0.2 million tons in world demand for phosphate rock, respectively. Furthermore, a one percent increase in world income is expected to result in an increase of 0.3 million tons in the world demand for phosphate rock, whereas an increase of one million tons of consumption of phosphate rock in the previous year is expected to increase world demand for phosphate rock by 0.3 million tons.

Equation (8) has been estimated in order to depict the adjustment process of actual to desired levels of demand. This process, however, is done through the Koyck distributed lag mechanism in the following manner:[2]

$$(Y_t - Y_{t-1}) = B\,(Y_t^* - Y_{t-1})$$

where B is the adjustment coefficient.

The above mechanism can be written as:

$$Y_t - Y_{t-1} = BY_t^* - BY_{t-1}$$

or

$$Y_t = BY_t^* + (1-B)(Y_{t-1})$$

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1. Ibid., pp. 276-278, 396.

2. See, Zvi Griliches, 'Distributed Lags Survey', Econometrica, Vol. XXXV, No. 1 (January 1967), 16-18.

If Y_t^* is substituted by its function, the following equation is obtained:

$$Y_t = BY^* F(x_1, x_2, x_3, x_4) + (1 - B)Y_{t-1}$$

The value of B assists in obtaining the speed of adjustment of actual, to desired, levels of demand. That is, to reach the equilibrium level between actual and desired levels of demand.

Moreover, the average adjustment lag and the variance can be calculated in the following manner:[1]

$$E\theta = \frac{\gamma^-}{(1 - \gamma^-)}$$

and

$$V\theta = \frac{\gamma^-}{(1 - \gamma^-)^2}$$

where $E\theta$ is the average adjustment lag, and $V\theta$ is the variance, and γ^- is the coefficient of the lagged dependent variable or $\gamma^- = (1 - B)$.

Accordingly, from the regression equation,

$1 - B = 0.26$, therefore $B = 1 - 0.26 = 0.74$.

Therefore, 74 percent of the disequilibrium will be removed in the first year.

The average adjustment lag, however, is:

$$E\theta = \frac{0.26}{1 - 0.26} = \frac{0.26}{0.74} = 0.35$$

which means that it takes about one third of a year for the actual demand level to adjust to the desired demand level. Moreover,

$$V\theta = \frac{0.26}{(1 - 0.26)^2} = \frac{0.26}{0.55} = 0.473 \approx 0.47$$

The standard deviation, therefore, equals the square root of the variance of $S = \sqrt{0.47} = 0.685$, which means that in 68 percent of cases the time necessary to close the gap between actual and desired levels of demand

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1. See, M. I. Nadiri, 'The Determinants of Trade Credit in the United States Total Manufacturing Sector,' Econometrica, Vol. XXXVII, No. 3 (July 1969), 414-417.

falls in the range of $\pm$ 0.685 of a year from the time of the average lag.

PART FOUR: SUMMARY AND CONCLUSION

(i) The essential constituent of phosphate rock is the element phosphorus which is vital as a nutrient of plants. It also performs various biochemical functions in all organisms. Therefore, the demand for phosphate rock depends mainly on the demand for chemical fertilizers derived from phosphorus. About 85 percent of world phosphate rock production is consumed in the manufacture of phosphatic fertilizers, and their variants, while most of the remaining 15 percent is used in industrial processes.

(ii) Between 1964 and 1974, world consumption of phosphate rock increased exponentially, growing at an annual average of 7.6 percent. Growth is expected to continue at this level as world population, and hence the demand for chemical fertilizers and industrial goods, continue to grow. Furthermore, it is notable that developed countries are the main consumers of phosphate rock, since they are the main producers of chemical fertilizers. The trend, however, is for consumption to increase at a decreasing rate in developed areas, and increase at an increasing rate in developing areas. This shift is taking place at a very slow rate at the present time, but it is expected to develop faster when developing countries start constructing their own chemical fertilizer industries.

(iii) The estimate of equations (3a and 4a) indicates that phosphatic fertilizers, on the one hand, and nitrogen and potash fertilizers, on the other, are very weak substitutes.

(iv) The static and dynamic equations (6 and 8) each explain a large part of the variation in the quantity demanded of phosphate rock. In both equations the average price per ton of phosphate rock appears to be the most important explanatory variable for changes in world demand for phosphate rock.

(v) According to equation (8), 74 percent of the disequilibrium between the actual and the estimated levels of demand will be removed in the first year.

CHAPTER THREE: THE BALANCE OF SUPPLY AND DEMAND IN THE PHOSPHATE ROCK WORLD MARKET

Chapters One and Two have analysed the production and demand sides of the world phosphate rock industry. This chapter will examine the current and future balances of supply and demand for phosphate rock in the world market. Data on production and consumption of phosphate rock are assumed to indicate the changes in the overall balance of supply and demand, although they are not the ideal indicators of the market balance. Therefore, possible shortcomings are unavoidable.

PART ONE. CURRENT BALANCE OF SUPPLY AND DEMAND

During the period 1960 to 1974, world production and consumption of phosphate rock rose substantially. World production increased from 33.5 million tons in 1960 to about 117 million tons in 1974 (an annual average increase of 9.8 percent). Consumption, on the other hand, rose by an annual average of 8 percent, from 40 million tons in 1960 to 113 million tons in 1974. Table III. 1 shows that the growth rates of both phosphate rock consumption and production, and the overall balance of supply and demand, have varied during this period.[1]

It can be seen that between 1960 and 1964 the consumption of phosphate rock exceeded production and that it grew at an annual average rate of 7.8 percent. Production, however, grew at an average annual rate of 7.2 percent. The relatively high average annual rate of growth of consumption was mainly due to the expansion in the fertilizer industry in developed economies. This expansion was necessary to secure an acceleration in the growth of agricultural output as a safeguard against anticipated food shortages caused by rising world population. Therefore, the expansion in fertilizer industries and the over-optimistic expectations of future increases in the

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1. See Figure III. a, and Appendix III. A.

TABLE III. 1

The Current Balance of Production and Consumption of Phosphate Rock In the World Market, 1960 - 1974

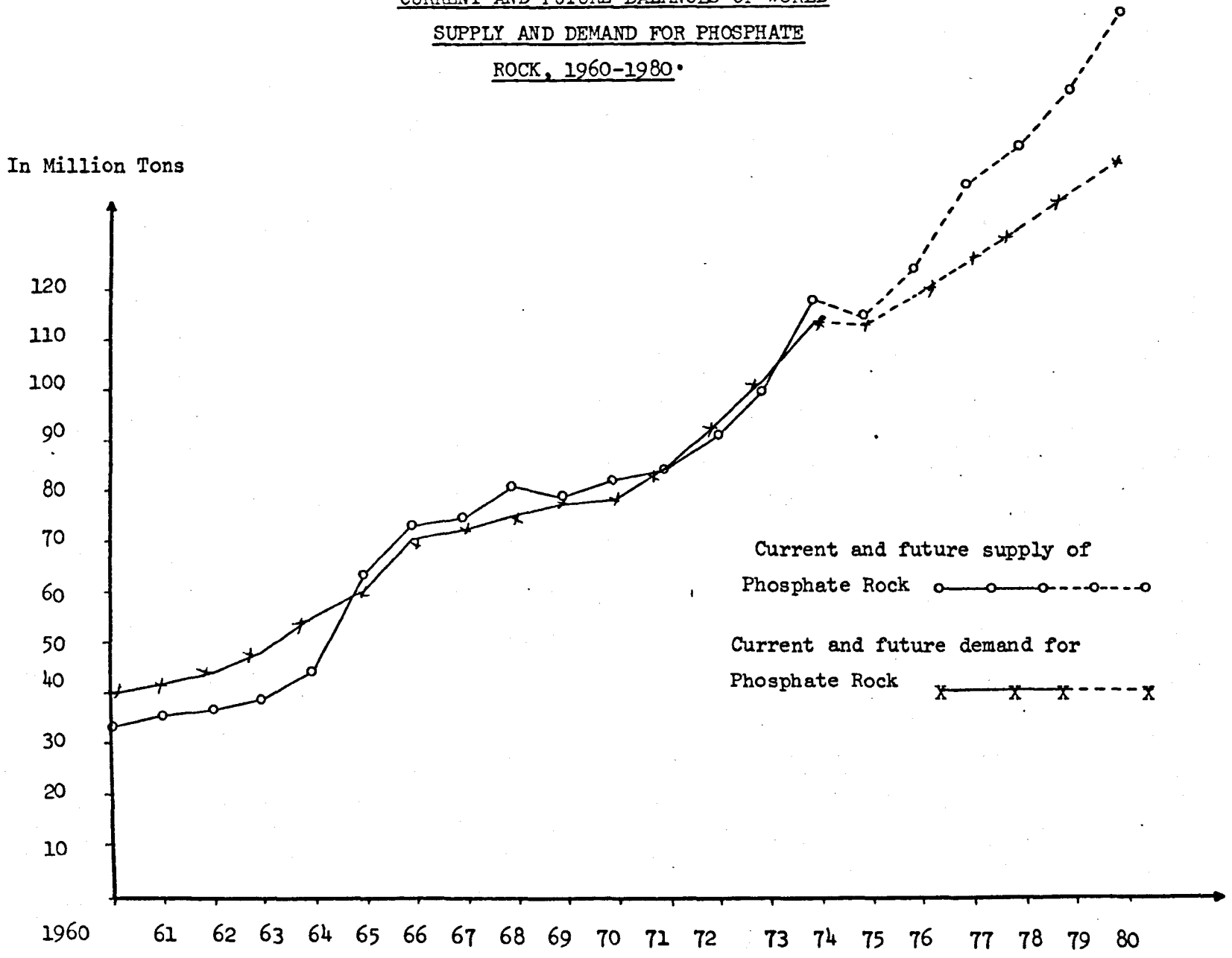
Year	Difference Between Production and Consumption in million tons	Percentage Change in Production	Percentage Change in Consumption	Ratio of Consumption to Production
1960	- 6.5	-	-	1.2
1961	- 6.5	6.0	5.0	1.2
1962	- 7.1	4.0	4.8	1.2
1963	- 9.6	4.1	6.8	1.3
1964	- 10.9	14.8	14.6	1.2
1965	3.0	42.9	9.1	0.95
1966	3.1	16.0	16.7	0.96
1967	2.8	2.3	2.9	0.96
1968	5.7	7.9	4.2	0.93
1969	1.7	- 2.5	2.7	0.98
1970	4.0	4.2	1.3	0.95
1971	0.5	3.1	7.7	0.91
1972	- 1.0	7.7	9.5	1.1
1973	- 1.7	9.1	8.2	1.0
1974	4.1	17.9	11.9	0.96

Average annual growth of Production between 1960 and 1964 = 7.2 percent.
Average annual growth of Consumption between 1960 and 1964 = 7.8 percent.
Average annual growth of Production between 1964 and 1971 = 10.6 percent.
Average annual growth of Consumption between 1964 and 1971 = 6.4 percent.
Average annual growth of Production between 1971 and 1974 = 11.6 percent.
Average annual growth of Consumption between 1971 and 1974 = 7.9 percent.
Average annual growth of Production between 1960 and 1974 = 9.8 percent.
Average annual growth of Consumption between 1960 and 1974 = 8 percent.

Source: Appendix III. A.

FIGURE III.a.

CURRENT AND FUTURE BALANCES OF WORLD SUPPLY AND DEMAND FOR PHOSPHATE ROCK, 1960-1980.



demand for phosphate rock encouraged existing producers to increase their capacity, and new producers to enter the market. Hence, between 1964 and 1971 production outstripped consumption and grew at an annual rate of 10.6 percent. Consumption, however, grew only at an annual average rate of 6.4 percent. The deceleration in the rate of growth in world consumption of phosphate rock resulted from the decline in the world consumption of fertilizers. The growth of such consumption fell from an annual average of 9 percent between 1962 and 1967 to an annual average of 5.8 percent during the period 1967 to 1972.[1]

By the late 1960's, the level of world demand for phosphate rock was low although production was increasing. The rise in production was due to the completion of many expansion plans administered by producing countries. Consequently, huge stocks of phosphate rock accumulated and led to a decline in the world selling prices of phosphate rock.

By 1969, prices were in many instances hardly sufficient to cover the direct costs of producing and handling phosphate rock. Hence, most producers suffered huge operating losses and were forced to compete intensely. In the United States, for example, this situation led to the formation of the Phosphate Rock Export Association (Phosrock), a cartel for handling the exports of a number of American producers.[2] However, the world market began to recover before the Association could become fully operational.

By 1972, for the first time since 1964, consumption of phosphate rock exceeded production by about one million tons. But, by the end of 1974 production had again risen well above consumption, mainly due to the substantial increases in output encouraged by the temporarily favourable

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1. Robertson International Research Ltd., Report on Market Appraisal of Rock Phosphate, (London: 1974), p. 96.

2. These American producers include W. R. Grace, International Minerals and Chemicals, and Occidental Chemicals. Source: Ibid., p. 79.

market. The effect on prices, however, was initially cushioned by the presence of large stockpiles. By mid 1973, dramatic price increases were being announced - a situation which continued into 1974.

In short, therefore, changes in the state of the world market can be attributed to the following main causes.[1] Firstly, Florida producers faced difficulties in maintaining shipments of phosphate rock at contracted levels due to the under-investment in the Florida mines during the period of depressed prices. Additionally, there were delays in operating new sources due to technical difficulties in other areas of the world, like Bu-Craa in the Spanish Sahara. Secondly, the world demand for phosphate rock increased substantially in 1973 following the disastrous world harvests of the preceding year when grain output actually fell by some 30 million tons. This crop failure led to large purchases of grain on the world market by countries such as Russia, India and China. This in turn led to a rapid rundown of American stockpiles of grain and a sharp upward movement in grain prices in the following year. As a result, intense efforts were made to raise grain production, causing the increase in demand for fertilizer products, including phosphate fertilizers.

The manufacturers of chemical fertilizers, who had suffered from the lack of demand for their products during the depressed market conditions of the late 1960's, renewed their investment programmes. In 1975, although consumption of phosphate rock continued to grow at a high level, production was picking up at higher rates than expected. Thus, the stockpiles which have been accumulating in consuming countries may influence the rate of growth of consumption in the near future.

The combined effect of these factors, together with the shortage of foreign currencies in some importing countries has already resulted in a decline in the world demand for phosphate rock, shown in the preliminary statistics for 1975.

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1. Ibid., p. 81.

PART TWO. EXPECTED FUTURE BALANCE OF WORLD SUPPLY AND DEMAND FOR PHOSPHATE ROCK

A. EXPECTED FUTURE WORLD SUPPLY

The supply of phosphate rock, in common with all natural resources, has two general features. Firstly, in the long run and at a given technology, the supply of phosphates is fixed; and secondly, the supply of phosphates is also fixed in the short run whether or not all existing plants operated at full or less than full capacity. Therefore, the supply of phosphate does not respond immediately to increases in world demand because of the time lag between increases becoming apparent and resources being diverted to exploit the new market opportunity. It follows that prices of raw materials such as phosphate rock react quickly to variations in demand.

Expected world production capacities for the period 1975-1980 are indicated in Appendix III. B. However, it must be emphasised that not all schemes and developments, as presently envisaged, will be implemented. Some of the projects may be modified, some may be abandoned, and other entirely new projects may be considered, depending on how markets develop and how phosphate rock prices move in the near future.

In any case, it is important to give some background information on expected developments in some main phosphate rock producing countries.[1] In the United States, plans for a significant expansion in phosphates production have been announced by the International Minerals and Chemicals Corporation, the Occidental Chemical Company, Texas Gulf, Agro-Chemical and Brewter Phosphates. Some estimates of the potential overall increase in American production have been as high as an additional 16 million tons by 1980.

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1. For a detailed analysis on expansion programmes, see, Robertson International Research Ltd., Report on Market Appraisal of Rock Phosphate, (London: 1974).

Information on plans for expansion of production in the USSR is particularly difficult to obtain. However, it seems possible that production at Kola could reach 18.0 million tons by 1980. Allowing for increases at Kara Tall as well, the USSR production of rock might be approaching 30 million tons by 1980. However, these estimates should be treated with extreme caution.

Finally, Morocco is planning to produce about 30 million tons by 1980. Production of phosphate rock in Morocco is currently centred in the Khouribga and Youssoufia regions. Output in the Khouribga region accounts for 80 percent of Morocco's production. At present, trial operations are also being carried out in the south of the Youssoufia region, but the results of these have not yet been announced. There are also definite plans to operate new mines at Ben Guerir, Sidi Hajjaj and Meskala. Production targets of 10 million tons per year each have been set at Ben Guerir and Sidi Hajjaj by 1980, and by 1990 at Meskala.

Therefore, the growth in world supply of phosphate rock will, in any case, outstrip demand. Table III. 2. indicates that world supply

TABLE III. 2.

Expected Growth Rates of World Production of Phosphate Rock, 1975-1980

Year	Annual Rate of Growth (in percentage)
1975	-
1976	7.8
1977	13.6
1978	5.6
1979	7.5
1980	4.8
Average annual rate of Growth, 1980-1975	7.9

Source: Appendix III. B.

is expected to grow at an annual average of about 8 percent over the whole period 1975 to 1980. It is expected to grow at a yearly average of 10.7 percent between 1975 and 1977 and fall to about 5 percent per year by 1980.

B. EXPECTED FUTURE WORLD DEMAND

Given that the predominant end-use of phosphate rock is in agriculture, and the demand for phosphate rock is essentially derived from the demand for fertilizer products, the future growth in world phosphate rock demand will depend mainly upon the future growth in the demand for fertilizer products. This depends mainly upon the future growth in world population and food requirements. Phosphate fertilizers, however, may be applied to crops in a number of ways; row placement, drilling in the surface soil, and broadcasting on the soil surface followed by discing or harrowing, are probably the most common techniques of application. A combination of different procedures, however, may be used for a given crop. It is important to realize that the method of placement to be used is largely determined by the crop grown, the type of fertilizer used, and the system of soil management followed relative to phosphate use.[1]

For the last decade, world population has been growing at an annual average rate of 2 percent and is expected to continue at this rate throughout the next decade. On the other hand, world food production grew at an annual rate of 2.7 percent over the last decade.[2] The rate of increase of per capita food production, however, varied widely and ranged between an average of 1.8 percent per year for developed countries and 0.1 percent for developing countries.[3] The world demand for food is expected to grow at about 2.5 percent per year during the next decade.[4]

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1. For a detailed analysis on methods and techniques of phosphate fertilizer placement and the chemical processes involved, see J. R. Van Wazer, Phosphorus and its Compounds, (New York: Interscience Publishers Inc., 1961), pp. 1461-1545.
2. Robertson International Research Ltd., op. cit., p. 96.
3. Ibid., p. 96.
4. Ibid., p. 96.

The F.A.O. estimated the world consumption of phosphate plant nutrient in the form of manufactured fertilizers to be about 22.8 million tons of (P_2O_5) in 1972/1973. This represents an annual average increase of 6.5 percent compound over the last two decades.[1] However, the actual rate of growth has varied cyclically from as low as 3.5 percent in 1969/1970 to as high as 12 percent in 1965.[2] Various forecasts have been made recently concerning world fertilizer requirements.[3] The need for phosphorus was estimated to lie between 31 and 40.5 million tons by 1979/1980, representing an average growth rate of between 4.5 and 8.5 percent per year based on 1972/1973 levels of (P_2O_5) consumption. One must add to these figures the direct consumption of phosphate rock for industrial and other purposes. Therefore, these figures translate to approximate phosphate rock requirements of between 135 and 165 million tons by 1980. Hence, a realistic future forecast for world phosphate consumption in 1980 is likely to be somewhere between 140 and 150 million tons, considering the present economic outlook. Based on 1973 figures, this would mean that world consumption of phosphate rock would grow at an annual average rate of between 4.9 and 5.9 percent. Such a rate would be reasonably consistent with past experience when consumption averaged 8 percent a year during the period 1960 to 1974, and the future expectation is a lower average annual growth rate.

However, an attempt was made in this study to forecast the consumption levels of phosphate rock between 1975 and 1985. In forecasting, two types of error could occur. One error could occur in predicting the unknown value of an independent variable, and the other could occur in predicting the partial regression coefficient.[4]

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1. Ibid., p. 96.

2. Ibid., p. 97.

3. These forecasts include those undertaken by Tennessee Valley Authority, F.A.O., I.B.R.D., U.N.I.D.O. and a number of other forecasts made in various mining and chemical journals.

4. Henry Theil, Applied Economic Forecasting, (Amsterdam: North-Holland Publishing Company, 1966), pp. 8-10.

Data on the independent variables considered in equation (8) are estimated with the aid of multiple regression analysis. The following linear functions are achieved:

$$x_1 = a_1 + b_1 t_1, \text{ or } x_1 = + 93.894 + \underset{(0.1)}{6.5035}\ t_1 \text{ ------} \quad (9a)$$

$$x_2 = a_2 + b_2 t_2, \text{ or } x_2 = + 3.866 + \underset{(0.50)}{0.9702}\ t_2 \text{ ------} \quad (9b)$$

$$x_3 = a_3 + b_3 t_3, \text{ or } x_3 = + 191.665 + \underset{(3.80)}{11.5184}\ t_3 \text{ ----} \quad (9c)$$

$$x_4 = a_4 + b_4 t_4, \text{ or } x_4 = +366.538 + \underset{(3.15)}{6.2309}\ t_4 \text{ -----} \quad (9d)$$

$$x_5 = a_5 + b_5 t_5, \text{ or } x_5 = + 40.909 + \underset{(0.29)}{4.6678}\ t_5 \text{ -----} \quad (9e)$$

The estimated values for the independent variables are found by mere substitution of the time values in the above equations. These estimates are presented in Table III. 3. They are used in estimating the world demand for phosphate rock for the period 1975 to 1985, by substituting their estimated values in the static and dynamic demand models (equations 6 and 8). The estimates of world demand for phosphate rock are presented in Table III. 4. They cover the period 1975 to 1985.[1] However, these estimates must be evaluated according to some testing measures such as the Theil-U -statistic, the mean square prediction error, and the prediction-realization diagram.

The Theil's-U-statistic measures the degree of relationships between a set of forecast data and the actual values and is given by the formula:[2]

$$U = \frac{\left\{(Pi - Ai)^2\right\}^{\frac{1}{2}}}{(Pi^2)^{\frac{1}{2}} + (Ai^2)^{\frac{1}{2}}}$$

where (P) is the estimated value and (A) is the actual one. U lies between 0 and 1 with a value of zero indicating perfect agreement and a value of one indicating a complete absence of agreement. Accordingly, when this

1. According to the forecasts, using equation (8), the demand or consumption of phosphate rock will grow by an annual average rate of 4.0 percent during the period 1975-1985, from 105.7 million tons in 1975 to 155.08 million tons in 1985.

2. Leroy H. Matell and Francis P. Spring, Economics for Business Decisions, (New York: McGraw Hill Book Company, 1972), pp. 162-164.

TABLE III. 3.

Estimates of the Determinates of World Consumption of Phosphate Rock, 1975 - 1985.

Year	Income (index no.)	Price/ ton of Phosphate Rock (in U.S. $)	Price/ ton of Phosphatic Fertilizers (in U.S. $)	Price/ ton of Nitrogen Fertilizers (in U.S. $)	Consumption of Phosphate Rock in tons, lagging one year behind
1975	178.44	16.48	341.43	447.53	101.62
1976	184.89	17.45	352.95	453.76	106.29
1977	191.39	18.42	364.47	459.99	110.96
1978	197.89	19.39	375.99	466.22	115.63
1979	204.39	20.36	387.51	472.45	120.30
1980	210.89	21.33	399.03	478.68	124.97
1981	217.39	22.30	410.55	484.91	129.64
1982	223.89	23.27	422.07	491.14	134.31
1983	230.39	24 .24	433.59	497.37	138.98
1984	236.89	25.21	445.11	503.60	143.65
1985	243.39	26.18	456.63	509.83	148.32

Source: Calculations based on equations 9a to 9c.

TABLE III. 4.

Estimates of World Demand for Phosphate Rock, 1975 - 1985

(in million tons)

Year	According to Equation (8)	% Change	According to Equation (6)
1975	105.67	-	103.36
1976	111.87	5.9	↓
1977	116.67	4.3	
1978	121.47	4.1	
1979	126.27	4.0	
1980	131.09	3.8	127.42
1981	135.90	3.7	↓
1982	140.70	3.5	
1983	140.50	3.4	
1984	150.30	3.3	146.22
1985	155.08	3.2	150.92
↓			
Annual average during 1975-1985		3.9	

Source: Own calculations based on equations 6 and 8 and Table III. 3.

formula is applied to data in Table III. 5, the U-statistic is:

$$U = \frac{(33.27)^{\frac{1}{2}}}{(75137)^{\frac{1}{2}} + (74962)^{\frac{1}{2}}} \approx \frac{5.7}{274 + 273} \approx \frac{5.7}{547} \approx 0.01$$

Therefore, the agreement between the actual and the estimated demand values is strong since the U-statistic is very near to zero.

On the other hand, the mean-square prediction error for a set of observations (n) measures the quality of a set of forecasts or the seriousness of a given forecast error. This measure is given by the formula:[1]

$$Ms = \frac{1}{n} \left\{ \sum_{i=1}^{n} (Pi - Ai)^2 \right.$$

where (P) and (A) are as defined earlier and Ms is the mean-square prediction error. However, frequently, the square root of this measure is considered to obtain a measure which has the same dimensions as the predicted and actual values of the dependent variable. Accordingly, by applying this measure to data in Table III. 5, the Ms is found to be:

$$Ms = \frac{1}{12} \times 33.27 = 2.77$$

and therefore the root mean square prediction error is

$$RMs = \sqrt{2.77} \approx 1.67 \text{ percent}$$

Finally, the prediction realization diagram is used as a measure of the seriousness of a given prediction error.[2] Suppose there is a time series of point predictions and realizations on a certain variable and that, as a whole, the forecasts and realizations are (Pi_5) and (Ai_5). From these values, a simple picture can be obtained by making a diagram with the predicted values measured along one axis and the realized or actual values along the other axis. If one is interested in the question, 'what is the distribution of the predictions, given that the realizations are as they are?'

1. Henry Theil, op. cit., pp. 26-27.

2. For discussions on the prediction realization diagram, see Henry Theil, op. cit., pp. 19-26.

TABLE III. 5

Actual and Estimated Values of World Demand for Phosphate Rock, 1963 - 1974

(in million tons)

Year	Actual Demand Level	Estimated Demand Level
1963	48	47.66
1964	55	54.77
1965	60	63.02
1966	70	66.96
1967	72	71.59
1968	76	74.39
1969	77	78.15
1970	77	79.43
1971	84	84.09
1972	92	89.42
1973	101	101.28
1974	113	113.26

Source: From the computer runs, according to equation (8)

an obvious choice is to measure the realizations along the horizontal axis. The line of perfect forecasts can be shown in the diagram as the upward sloping straight line through the origin (with an angle of 45° with respect to the two axes). Any point on this line represents a case of perfect prediction; and any point which is not on this line represents a case of non-zero prediction error. This line plays a prominent role in the evaluation of the forecasts. The prediction-realization diagram will result from rotating the graph in such a manner that the line of perfect forecasts becomes horizontal. In this diagram all points above the horizontal line of perfect forecasts are overestimated and all points below the line are underestimated.

According to figure III. b, most of the predicted demand levels for equation (8) lie below the line of perfect prediction, thus most of the predicted values are underestimated. Moreover, the graph reveals that the estimated values are very near to the perfect prediction line, thus indicating that the prediction error is not serious at all.

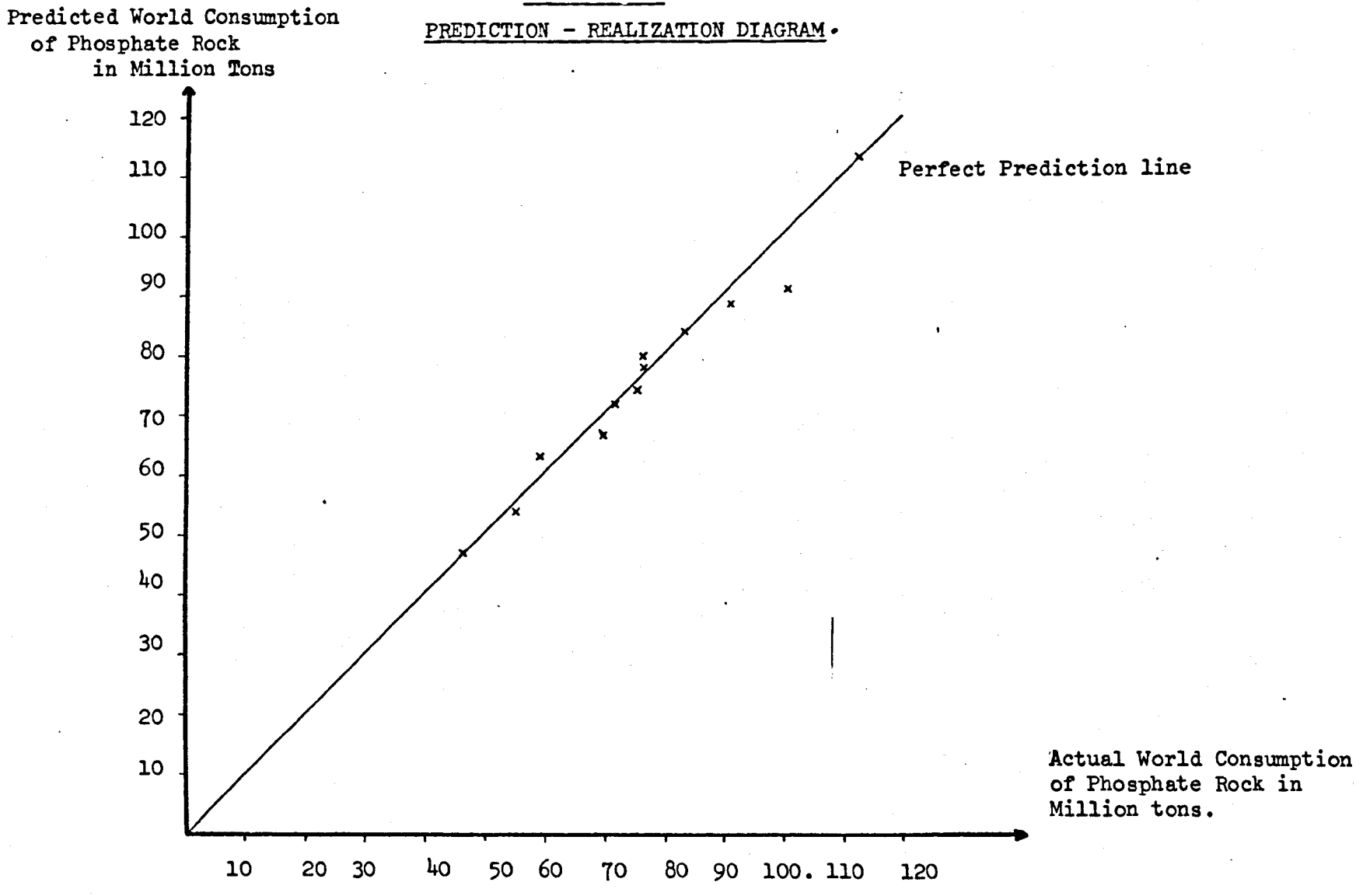
In the same manner, forecasts using equation (6) can be tested.

C. EXPECTED FUTURE BALANCE OF SUPPLY AND DEMAND

The preceding discussions on possible future growth rates of supply and demand for phosphate rock reveal that the world supply of phosphate rock during the next six to ten years is sufficient to meet world demand, even if it grows at an annual average rate of 10 percent. Hence, there will probably not be a shortage in phosphate rock in the near future. However, the extent of excess capacity, which is likely to occur starting in 1976/1977, will depend on how fast existing and new suppliers implement their development plans and whether such plans are revised upwards or downwards. Nevertheless, if the excess capacity lies in the range of 5 to 10 million tons a year, the problem will not be acute and any excess capacity could be handled among the exporting countries if they form trade associations

FIGURE III.b.

PREDICTION - REALIZATION DIAGRAM.



able to take collective measures to maintain a balance between world supply and demand. They should then be able to prevent any slump in selling prices such as occurred between 1969 and 1972.

Therefore, the high selling prices of phosphate rock prevailing in 1974 and the beginning of 1975 are not likely to be maintained in real terms by the exporting countries because in the long run they are likely to encourage many other countries to exploit their own low-grade deposits. This might lead to a serious cut-back in the volume of exports and introduce government subsidised phosphate rock operations in a number of countries such as India, Yugoslavia, Syria, Iraq, Canada, Australia and Brazil, amongst others.

PART THREE: SUMMARY AND CONCLUSION

(i) World phosphate rock production grew at an annual average rate of 9.8 percent during the period 1960 to 1974. World consumption, however, grew at an annual average of 8 percent.

(ii) Between 1960 and 1964, and 1972 to 1973, world consumption exceeded production; but between 1965 and 1971, and in 1974, world production of phosphate rock exceeded consumption. It is noteworthy that changes in the state of the world phosphate market were directly affected by changes in the world demand for chemical fertilizers.

(iii) As expected, changes in the levels of demand and supply caused variations in the world price of phosphate rock and affected programmes of expansion in countries producing phosphate rock.

(iv) The growth in world supply of phosphate rock will probably continue to exceed the growth in world demand. Hence, in the near future, no shortage of phosphate rock is expected in the world market. Supplies of phosphate rock are expected to grow at an annual average rate of about 8 percent between 1975 and 1980, while demand is expected to grow at an annual average rate of between 4 percent and 6 percent.

CHAPTER FOUR: DEVELOPMENTS IN PHOSPHATE ROCK WORLD TRADE

After discussing the production and consumption of the world phosphate rock industry and the current and future balances between the supply of, and demand for, phosphate rock, this chapter analyses the marketing aspects of this industry.

PART ONE. DOMESTIC AND INTERNATIONAL MARKETING: A THEORETICAL BACKGROUND

Marketing has no recognized central theoretical basis such as exists for many other disciplines. Therefore, marketing has been defined in many ways.[1] For our purposes, however, we refer to marketing from a managerial point of view which considers marketing as a management function that organises and directs all those business activities involved in assessing and converting customer purchasing power into effective demand for a specific product or service, and in moving the product or service to the final consumer or user so as to achieve the profit target or other objective set by the producer.[2] Accordingly, marketing incorporates[3]: marketing assessment and sales forecasting; the formation of marketing policies; the planning and operation of marketing organisations - internal and external - for achieving a desired level of sales and for dealing with customers; sales promotion; the costing and budgeting of marketing effort; and the measurement of results by reference to internal data and results of market research.

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1. For details on different views and definitions of marketing, see, M. Halbert, The Meaning and Sources of Marketing Theory, (New York: MacGraw-Hill Co. Ltd., 1965), pp. 1-9, M. J. Baker, Marketing: An Introductory Text, (London: MacMillan and Company Ltd., 1971), pp. 1-40, Robert Bartels, 'The General Theory of Marketing', Journal of Marketing, XXXII (January 1968), pp. 29-33.

2. Douglas W. Smallbone, An Introduction to Marketing, (London: Staples Press, 1968), p. 11.

3. Ibid., p. 12.

Domestic and international marketing differ, in that the latter involves more than one nation and therefore is defined as the performance of business activities that direct the flow of producers' goods and services to customers or users in more than one nation.[1] This difference may seem minor, but it surely accounts for the complexity and diversity found in international marketing operations.

The recent changes in competitive structures and shifts in demand characteristics in world markets have enhanced the interest in international marketing. In general, there are four recognised categories of international marketing involvement:[2] no marketing overseas; infrequent marketing overseas; regular marketing overseas; and world marketing operations. A producer often moves through these categories one at a time, although it is possible for him to skip one or more. The complexity and sophistication of international marketing, however, tends to increase with moving from one level to a more involved one. In the early stages of foreign marketing, a producer generally relies almost entirely on an epxerienced export firm to handle his marketing tasks. However, as he gathers more experience and his involvement becomes increasingly more permanent, he may engage his own personnel to sell in specific foreign markets. Ultimately, when he reaches a point of dependence upon the foreign market, he runs his total marketing task and ceases to delegate his marketing responsibility to a third party. This, however, does not mean that he does not utilise the services of an intermediate organisation. In such a case he practises that within the general framework of a total marketing plan designed to achieve specific objectives.

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1. John M. Hess and Philip R. Cateora, International Marketing,(Chicago: Richard D. Irwin Inc., 1966), p. 4.

2. Ibid., pp. 5-9.

The marketing of phosphate rock in world markets is a very complex operation. 'It requires people skilled and experienced not only in salesmanship but also in barter deals, foreign exchange, trade discounts, product quality, import regulations, trade balances, shipping costs and practices, and many other facets of the operation.'[1]

At this point, it is necessary to give a brief description of the present general organisation and processes of marketing of the world phosphate rock industry. Marketing activities for phosphate rock generally include: the selling of rock; purchasing and assuring the availability of supplies; storage and release of these supplies; planning transport to ports for exports; the handling of phosphate rock at ports; loading on board ships; and the planning and execution of ocean transport.

Markets, like people, appear to be 'creatures of habit.' Forms of distribution and marketing practices once established, usually persist for considerable periods of time. They play important roles in defining the nature of the process establishing prices and in determining the character of the responses by firms to changes in supply and demand. The absence of any organised commodity exchange for phosphate means that the present distribution system and marketing practices of phosphate rock producers should be discussed.

Phosphate rock in general is either sold locally or in international markets.[2] Local sales are generally concluded either directly with consumers or through middle-men or intermediate organisations depending on the quantities in question and the type of buyer, for example, whether it is a farmer or an industry. Foreign sales, however, are generally made through one or more of the following channels: agreements concluded through direct private contact between the producer and foreign industrial firms;

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1. Stanford Research Institute, Markets for Jordan Phosphate Rock, (California: Menlo Park, 1963), p. 68.

2. Phosphate rock marketed abroad is usually of higher grade.

bilateral agreements concluded between governments, and agreements concluded through a third party such as agents.

Transactions carried out under bilateral agreements between governments might be through barter deals or through confirmed and irrevocable letters of credit. Additionally, agreements concluded through agents have been an important channel in effecting sales to foreign markets.

Producers generally use advertising to promote sales. Advertising is an impersonal persuasive communication in media not owned by the producer, and designed to communicate with the maximum number of potential customers in such a way that they will be informed of the product or service in their own terms.[1] Advertising for phosphate rock is often carried out by contributing to international fairs and occasionally by placing advertisements in magazines with particular interests in phosphate rock, such as the Mining Annual Review or in some local magazines in export markets. Marketing procedures are essentially the same for all phosphate rock producers: differences occurring with the size and volume of advertising, and the number of agents and representatives.

PART TWO. PRICING POLICIES AND PRACTICES

A. PRICING POLICIES

Prices of phosphate rock are quoted on a per ton basis of B.P.L. content in percentages, and are declared as list prices at source in Florida and Morocco. These list prices, however, do not accurately reflect the picture of actual prices in the international phosphate rock market. They only serve as a basis for negotiating final prices which are often kept secret. Phosphate rock selling prices are affected by the grade of the rock, transport costs, and bilateral commercial agreements between the negotiating parties. Therefore, when deciding upon his pricing policy, an exporter must at least

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1. Douglas W. Smallbone, Op. Cit., pp. 123-124.

equate the C.I.F. prices in major markets of his own phosphate rock, after adding or subtracting any quality or freight differential with those of his principal competitors, usually Moroccan and/or Florida producers.[1] When there is a freight advantage, the addition should be cautiously small because of the efficient chartering of vessels by major suppliers; and when there is a disadvantage, the subtraction should be cautiously large for the same reason.[2] In some cases, however, an exporter must be ready to offer discounts in particular markets. Such discounts are not necessarily shown in contracts or on invoices: they can be offered in the form of additional phosphate rock quantities, or they can be disguised in the C.I.F. quotations.

Sales of phosphate rock may be effected on C.I.F., F.A.S. or F.O.B. basis, depending on the level of freight rates and general market conditions.[3] When freight rates are low, sales on C.I.F. basis are preferred. Important buyers, in some cases, prefer to use their own shipping facilities and therefore sign their contracts on a F.O.B. basis, whereas producers of phosphate rock owning shipping facilities, like Morocco, press their customers to buy on a C.I.F. basis. Smaller buyers, on the other hand, may consider freight arrangements a useful service to be undertaken by the seller. Hence, for a seller to be competitive, he must be ready to effect sales as desired by buyers. He must also have continuous market intelligence reports to match his competitors' quotations, and employ a shipping expert to advise him on freight matters. The services of an efficient chartering organisation could, therefore, enable him to gain a better profit margin on C.I.F. quotations than he could hope to obtain on F.O.B. quotations. Another way of securing higher profit margins is by selling on a F.O.B.

1. The Economist Intelligence Unit, The Expansion of Phosphate Industry in Jordan, (London: Economist Intelligence Unit Press, 1965), p. 3.

2. Ibid., p. 3.

3. C.I.F. means cost, insurance and freight; F.A.S. stands for Free alongside ship; and F.O.B. for Free on board ship.

basis and at the same time reserving the right to arrange the freight for an additional fee.

B. DEVELOPMENTS IN PHOSPHATE ROCK PRICES

Phosphate rock world prices were characterised by relative stability over the period 1953-1973, ranging between U.S. $ 11 and U.S. $ 14 per ton, depending on the B.P.L. content.[1] Competition between producers, therefore, took place on grounds of negotiating ability and marketing techniques rather than by cutting prices.

Since Florida and Morocco are the main phosphate rock producers, their list prices are taken to reflect the movements in phosphate rock prices. In the period 1960 to 1964, the Moroccan list prices were less uniform than those of Florida. Tables IV. 1 and IV. 2 show that, for phosphate rock of grade 70/72 percent B.P.L., the Florida prices were about U.S. $ 1.50 per ton lower than Moroccan prices prior to 1st July, 1964 and about U.S. $2.00 per ton lower afterwards. On the other hand, the price for Florida phosphate rock of grade 76/77 percent B.P.L. both before and after 1st July 1964 was between U.S. $1.00 and U.S. $ 1.50 per ton lower than the price of Moroccan phosphate rock of grade 75/77 percent content of B.P.L. However, the real differential was wider due to the two different bases of selling which were to Florida's advantage.[2] Firstly, Florida sold on a F.O.B. basis per long ton, whereas the Moroccans sold on a F.A.S. basis per metric ton. Therefore, to make their prices comparable, loading charges of at least 20 cents per ton should be added and the Moroccan F.A.S. price per metric ton should be converted into price per long ton.[3] Secondly, Florida used to guarantee the upper figure in the B.P.L. bracket, whereas Morocco used to guarantee the lower figure.

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1. B.P.L. means bone phosphate of lime.
2. Economist Intelligence Unit, op. cit., pp. 2-3.
3. 1 long ton = 1.016 short tons.

TABLE IV. 1.

Florida List Prices of Phosphate Rock for West European and Japanese Markets

($ per long ton F.O.B.)

% B.P.L.	1960	1961(a)	1962	1963	1964(b)
64/66	6.55	6.8/6.7	6.70	6.70	6.70/7.37
66/68	6.85	7.10/7.0	7.00	7.00	7.00/7.70
68/70	7.50	7.75/7.65	7.65	7.65	7.65/8.42
70/72	8.00	8.30/8.20	8.20	8.20	8.20/9.02
71/73	-	8.55/8.45	8.45	8.45	8.45/9.30
74/75	9.00	9.50/9.25	9.25	9.25	9.25/10.18
76/77	10.00	10.50/10.25	10.25	10.25	10.25/11.28
80/82	-	-	-	-	12.50/13.75

(a) Price changes on 1st January and 1st July.

(b) Price change on 1st July applied for Western Europe, but not to Japanese market until 1965.

Source: Economist Intelligence Unit, The Expansion of the Phosphate Industry in Jordan, (London: Economist Intelligence Unit Press, 1965), p. 1.

TABLE IV 2.

Moroccan Prices Quoted for Western Europe

($ per metric ton/F.A.S.)

% B.P.L.	Prior to 1st July, 1964	Figures Converted to $/long ton and loading fees	After 1st July, 1964	Figures Converted to $/long ton and loading fees
70/72	9.65 - 9.85	10.00 - 10.21	10.90 - 11.10	11.27 - 11.48
75/77	11.30 - 11.75	11.68 - 12.14	12.30 - 12.75	12.70 - 13.16
80/82	13.55 - 13.85	13.97 - 14.27	14.80 - 15.10	15.24 - 15.54

Source: Economist Intelligence Unit, The Expansion of Phosphate Industry in Jordan, (London: Economist Intelligence Unit Press, 1965), p. 1.

The real differentials in the Florida and Moroccan prices are justified partly by the costs of transatlantic freight which Florida had to pay, and partly by the differences in the quality of their phosphate rock. For example, in 1964, the average reported freight cost per metric ton from Casablanca(Morocco)to the Italian west coast ports was U.S. $4.0, whereas that from Tampa(United States)was U.S. $ 5.50.[1] Furthermore, the quality of phosphate rock is known to be superior to that of Florida, although some users prefer the Florida product. Preferences depend on the end-product and the type of plant being used.

Another interesting point for comparison is the premium attached to higher grades of phosphate rock.[2] Florida attaches between 15 cents and 50 cents for each additional percent of B.P.L.[3] Morocco, however, attaches between 30 and 50 U.S. cents for each additional percent of B.P.L.[4] These differentials are considered useful guides for a producer planning to to introduce new grades. They are also not immutable,for if the higher grades are in short supply, the premiums may rise to such an extent that manufacturers of fertilizers build new plants or convert existing ones to use lower grades.

During 1965, North African phosphate prices rose by about $ 1.25 per ton.[5] This move, however, was not followed by other phosphate rock producers. In 1966, phosphate rock prices maintained their generally low level. However, as a result of the fierce competition among producers to

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1. Ibid., p. 2.
2. Ibid., pp. 2-3.
3. 15 cents for lower ranges (66-68 percent B.P.L.) and 50 cents for higher ranges (75-77 percent B.P.L.).
4. 30 cents for lower ranges (70-75 percent B.P.L.) and 50 cents for ranges (75-88 percent B.P.L. content) after July 1964.
5. M. R. Freeman, 'Phosphate Rock', Mining Annual Review, May 1966, p. 82.

gain a larger share of the world market and due to the relative excess supply, United States producers made sales at levels significantly below their listed prices, although this did not apply to high-grade concentrates which were in relatively short supply.

During 1967, however, producers' pricing policies were confused, reflecting the difficult market situation. In west European and American markets, customers were able to obtain phosphate rock at relatively cheaper prices. On the other hand, Morocco introduced new pricing arrangements to maintain its competitive position in world markets. The market situation deteriorated when the Suez Canal was closed in that year, causing substantial increases in ocean freight charges. This forced customers in the Far East to press for concessions in the F.O.B. prices from their respective suppliers. This situation continued throughout 1968 and the prices still reflected a buyer's market due to the continuing excess supply in world markets.

During 1969, both consumers and producers were reluctant to disclose any information regarding actual prices. Thus the list prices were of little significance. In the more competitive markets, substantial discounts were offered and even became common practice. Therefore, phosphate prices underwent further deterioration, especially in Western Europe and North America where competition was most marked. In 1970 and 1971 phosphate rock prices again declined, although at a lesser rate than in 1969.

By the beginning of 1972, for the first time since the early 1960's producers were able to raise prices by up to U.S. $1.00 per metric ton.[1] In July 1972, 'Phosrock' published a new list price incorporating increases on all grades of U.S. $1.00 per ton to take effect on subsequent sales, whether under contract or on a spot basis. This move by 'Phosrock' was

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1. M. R. Freeman, 'Phosphate Rock', Mining Annual Review, 1973, p. 100.

followed by other major rock producers. In 1973, 'Phosrock' again raised its listed prices as indicated in Table IV. 3.

The change in the world market situation of phosphate rock led Morocco to sponsor an economic study which was presented in June 1973 at the annual meeting of the International Superphosphates Manufacturers' Association (I.S.M.A.). The study indicated that producers and sellers of chemical fertilizers and other by-products of phosphate rock were making high marginal profits by buying phosphate rock as a raw material at low prices and selling phosphatic fertilizers at high prices. Therefore, to balance the situation, Morocco proposed a substantial increase in phosphate rock prices. The Association, at its meeting, agreed that phosphate rock producers should benefit from their natural resource and therefore decided that the phosphate rock price should range between U.S. $ 35 and U.S. $ 39 per ton, depending on the B.P.L. content.[1] The Association, at its meeting in June 1974, decided to raise its prices again, to range between U.S. $ 48 and U.S. $ 50 per ton.[2] The successive increase in phosphate rock prices caused some uncertainty in world markets and subsequently producing countries started to sign half-yearly contracts in order to benefit from expected rises in phosphate rock prices. Customers also demanded more and more phosphate rock at current prices, to offset the prospect of higher prices in the future. By the end of 1974, phosphate rock prices had reached a high of between U.S. $ 60 and U.S. $ 68 per ton, depending on the B.P.L. content. Such relatively high prices remained in effect until June 1975, when members of the Association were convinced that the successive price increases had finally led to a decline in world demand for phosphate rock, as predicted by economic theory. Therefore, they decided at their meeting in June 1975 to cancel all the half-yearly contracts and keep prices stable

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1. Kingdom of Jordan, Jordan Phosphate Mines Comapny, Interview with the Sales and Marketing Manager, August 1976.

2. Ibid.,

TABLE IV. 3.

List Prices of Florida Phosphate Rock Declared by 'Phosrock', 1971-1973

(U.S. $ per ton F.O.B. Tampa or Jacksonville)

Grade % B.P.L.	July 1971	July 1972	March 1973	Percentage Change 1971/1972
76/77	11.28	12.28	14.50	28.6
74/75	10.18	11.18	13.10	28.7
72/73	9.30	10.30	12.00	29.0
70/72	9.02	10.02	11.50	16.4
66/68	7.70	8.70	9.90	28.6

Source: M. R. Freeman, 'Phosphate Rock', Mining Annual Review, 1973, p. 100.

to help re-establish confidence in the world market.[1] The decision to keep prices at their 1974 level was influenced by the following factors: firstly, it was observed that some European producers of chemical fertilizers and by-products of phosphate rock had stopped production due to the substantial decline in the differential between selling prices and prices of their raw materials; secondly, producers of chemical fertilizers and other by-products of phosphate rock imported large amounts of phosphate rock in the first six months of 1975 as a safe-guard against anticipated price increases. Therefore, they found themselves with substantial excessive quantities of phosphate rock which caused a sharp decline in the demand for phosphate rock. Exporting countries of phosphate rock have been competing very heavily since June 1975 to increase their sales and gain new markets. This has been done by selling at lower prices when signing secret bilateral agreements.

A comparison of Florida and Moroccan list prices reveals that the United States was merely following the price leadership of Morocco.[2] It is also of interest to note what happened to phosphate rock prices between June 1973 and June 1974. During 1974, the O.C.P. (Office Cherifien des Phosphates) was able to make a number of spot sales at prices well above the listed levels to buyers who had been unable to secure their phosphate rock requirements from traditional suppliers. The O.C.P. announced a 200 percent increase in their listed prices to become effective on all contracts starting in January 1974.[3] This increase represented a record level in post-war history of the world phosphate rock industry and took

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1. Ibid.
2. See, Tables IV. 4 and IV. 5.
3. Kingdom of Jordan, Jordan Phosphate Mines Company, op. cit.

TABLE IV. 4.

Price Movements of Phosphates Supplied by United States in 1974

(in U.S. $ per short ton F.O.B.)

Grade B.P.L. Base	July 1st 1974 (1)	Jan. 1st 1974 (2)	Jan. Ist 1974 (3)
66/68	-	9.40	14.40
68/70	6.24	9.94	16.19
70/72	-	10.92	17.98
72/73	7.42	11.72	19.78
73/75	7.67	12.35	21.10
75/77	8.45	13.69	22.89
77/78	9.44	15.29	25.12

(1) Issued April 1st, 1972.

(2) Issued October 1st, 1973; cancelled on November 16th, 1973. Superseded by schedule issued on November 16th, 1973.

(3) Issued November 16th, 1973.

Source: U.S. Bureau of Mines, Minerals Yearbook, 1973, (Washington D.C.: U.S. Government Printing Office, 1974), pp. 8-11.

TABLE IV. 5.

Prices of Phosphates Supplied by Morocco as of October, 1973

(U.S. $ per short ton F.O.B. Casablanca)

Grade B.P.L. Base	Price per ton
70/72	34.82
72/73	37.01
75/77	38.83
77/78	43.59
80/82	46.08

Source: U.S. Bureau of Mines, Minerals Yearbook, 1973, (Washington, D.C.: U.S. Government Printing Office, 1974), pp. 10-11.

the price of Morocco's product of grade 75 percent B.P.L. content up to U.S. $ 42.0 per ton.[1] In explaining its new policy, the O.C.P. pointed out that phosphate rock prices had been relatively stable since 1952. Most other suppliers of rock followed suit and tripled their export prices in 1974. However, Florida producers raised their prices by only 100 percent since they had a sizable domestic market to consider, and were against any price discrimination between domestic and export markets. (See,Table IV. 6.)

C. CARTEL FORMATION

The first cartel within the world phosphate industry was formed in 1964 by some Arab exporting countries. It was organised after a meeting of those countries in June 1964 and was called 'Amophos'.[2] During the same year, the Association agreed and implemented a 10 percent increase in their phosphate rock prices.[3] Such a move, however, was soon followed by most other principal phosphate rock producers. The price increase took European importers by surprise and they reacted by negotiating with exporters from the United States who were not then competing with Arab exporters in the European markets because of the high freight costs involved in transporting phosphate rock from ports in the United States to European destinations. As a result, the Americans decided to build huge cargo ships to ease their transport costs. The use of such large ships did indeed allow producers from the United States to compete with Arab producers in the European markets, and in fact even forced a fall in phosphate rock prices.

However, 'Amophos' did not prove to be entirely successful. Morocco, the largest exporter and producer of phosphate rock among the members of the Association, tended to control the operations of the Association and

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1. Ibid.,
2. The Arab countries include Tunisia, Morocco, Jordan and Algeria.
3. Kingdom of Jordan, Jordan Phosphate Mines Company, op. cit.,

TABLE IV. 6.

Prices of Phosphate Rock From the United States Between 1973 and 1975

(U.S. $ per ton)

Grade B.P.L. Base	1973	1974	1975	Percentage Change 1973/1975
66/68	13.10	55.0	55.0	320
68/70	12.00	48.0	48.0	300
70/72	11.50	43.0	43.0	274
72/73	10.50	39.0	39.0	271
75/77	9.90	36.0	36.0	264

Source: Kingdom of Jordan, JPMC, Sales and Marketing Department, (Amman).

was even able to decide and impose certain policies on the other members for her own benefit. These actions were harmful to other members such as Jordan. It is true that 'Amophos' was able to implement price increases which were beneficial to Jordan and other members as long as it did not prevent a flexible pricing policy or quotations. Any price fixing of this sort would make it essential for 'Amophos' to keep in touch with competitors' prices and at the same time provide its members with the fullest market intelligence. Unfortunately, such was not the case.[1] Another problem facing Jordan as well as other members of the Association was market sharing. In order to expand their operations significantly, the members of the Association could not afford to tie their hands in advance and not benefit from policies of some importing countries which preferred to buy from a variety of sources.

Another cartel was formed in the United States in 1971 by major phosphate rock exporters from Florida and was called 'Phosrock'. This organisation controlled three-quarters of the tonnage exported from the United States. In 1971, 'Phosrock' implemented a general policy to cut back discounts on phosphate rock prices as contracts came up for renewal, with a view to generating a progressive improvement in producers' net returns over two to three years. On behalf of its members, 'Phosrock' was able to conclude important contracts in 1972 with importers in Europe and Latin America at prices 50 cents to one dollar higher than the 1971 prices.[2] This represented the first real rise in export prices for five years. The formation of 'Phosrock' came as a result of the fierce competition among Florida producers in West European markets, which caused phosphate rock prices to decline to a critical level.

After consideration of such factors as: the uses and importance of phosphate rock; world reserves of phosphate rock; the market structure of the phosphate rock industry; world production and demand; anticipated

1. Kingdom of Jordan, JPMC, interview with the General Manager of JPMC, August 1976.
2. M. R. Freeman, 'Phosphate Rock', Mining Annual Review, 1972, p. 100.

production capacities and demand; and the relative importance of the world's leading suppliers, one might expect there to be a strong tendency for a world cartel among phosphate rock exporters to evolve. Such a cartel, however, would not be the first to evolve. Paul M. Gary once observed that,

> '... Since the world market was controlled by cartels from about First World War till 1945 when the U.S. Phosphate Rock Association was dissolved ..., the cartel development took the form of agreements allocating markets (chiefly European, which was the greatest area of consumption) among the various producers. Agreements were made with North African producers; phosphate island producers; all except Russia. This also tended to keep others out of the United States domestic market'. 1

Under the expected situation of excess supply on world markets, exporters of phosphate rock might form a world cartel to agree on sharing the world markets and restricting production to avoid direct competition and the inevitable price-cutting. Most African and Middle East phosphate rock producers could not afford a major cut-back in their revenues from sales of phosphate rock since they are dependent upon phosphate rock as a major source of income. This reason could make effective sharing agreements more difficult to achieve unless their special cases are carefully considered.

D. THE EXPECTED FUTURE PRICE TRENDS OF PHOSPHATE ROCK

The lack of data on production costs of principal phosphate rock producers and the uncertainty surrounding the future growth in both demand and supply, make forecasting phosphate rock prices in the world market a hazardous exercise. In theory, however, phosphate rock prices should equate approximately the long run marginal costs of production under a perfect market situation. However, due to the imperfection in the market mechanism and the cyclical factors affecting markets, prices are expected to deviate from the long run marginal costs.

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1. Paul M. Gary, the United States Phosphate Rock Industry and World Trade in Phosphate Rock, MBA Thesis, University of Pennsylvania, 1957, p. 225.

Therefore, in the expected case of excess supply, prices might be subject to similar pressures of the late 1960's, at least for a short while. Thus prices, as a result of the severe competition expected among exporting countries, would probably decline to a level sufficient to remove the excess supply. Under perfect market conditions, this level would be approximately equal to the short run marginal costs of each producer or the cost saved by a producer by reducing production. This, however, would not be the case in practice due to imperfection in the market situation.

Phosphate rock prices could also be affected by the extent to which producers are fully aware of their precise short run marginal costs of production. This depends on the availability of a suitable accounting system.

PART THREE: TRANSPORT OF PHOSPHATE ROCK BY SEA

Phosphate rock is usually transported in bulk either as full shiploads or sometimes as part-cargo. Bagged shipments are also very occasionally used.[1] The means of transport, however, can be on any size or type of ship which can also be used for a wide range of other cargoes. Therefore, the choice of size and type of ship to be used is governed by economic rather than technical considerations. However, certain bulk carriers have incorporated extensive cargo-handling equipment to speed up phosphate rock loading and discharging operations at ports or fertilizer plants which have inadequate shore-based facilities.

A. SHIPPING AND CHARTERING PROCEDURES UTILIZED IN PHOSPHATE ROCK SEA TRANSPORT

In general, the trading policies of individual countries affect the shipping arrangements for phosphate rock. The majority of phosphate rock shipments are arranged under barter or other bi-lateral trading agreements since phosphate rock mining industries in Africa and the Near East are

1. An example of such shipments are the exports of Jorphos to Ceylon by Jordan.

either owned by governments of such countries or they are subject to governmental control. Almost all phosphate rock imported by Eastern Europe is obtained under such agreements, where the rock shipments are considered as payments for technical or commercial aid.

Additionally, the responsibility for shipping arrangements depends on how the exporter wishes to sell his phosphate rock. Obviously, in cases of C.I.F. or C and F (cost and freight) sales, shipping arrangements and therefore the choice of size and type of ship, lies in the hands of the producer or the broking intermediary. In cases of F.O.B. or F.A.S. sales, responsibility for shipping arrangements and chartering lies in the hands of the buyer. It is noteworthy that despite secrecy over contracts, it is believed that a large portion of phosphate rock world trade is conducted on a long term F.O.B. or F.A.S. basis. Thus, leaving the responsibility for ocean transport of a high portion of phosphate rock entering world trade with the consuming, rather than producing organisations. Therefore, it is found that many fertilizer companies have integrated their shipping operations. They either became direct owners or managers of the ships employed in long term charters. As far as the chartering methods employed, a shipper of phosphate rock, after reviewing his forward requirements, can choose among the following methods:[1] (a) To charter a suitable ship for a single voyage. The freight rate in this case is based on either the weight of the cargo (voyage charter), or the duration of the voyage in days (trip charter). Therefore, the freight rate is set by the D.W.T. (Dead weight ton) or capacity of the ship concerned. (b) To time charter a vessel appropriate to the trade for an agreed period of time (months or years), and at so much per D.W.T. per month or per day. This method gives the shipper flexibility to combine the phosphate rock shipments with other commodities. (c) To sign a contract with an individual shipowner or a group of shipowners (pools or consortia) for the shipment

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1. H. P. Drewery, Phosphate Rock Shipping through Port of Aqaba, Jordan, (London: 1975), pp. 11-12.

of a specific amount of phosphate rock in tons between specified ports, and at defined intervals over an agreed period of time (contract of affreightment). Contracts under these terms are commonly signed to cover periods of between one and three years.

It should be noted that a sizable amount of world trade in phosphate rock is shipped under the terms of method (b). However, method (c) is usually preferred when cargo volumes are known in advance or at least can be estimated.

B. TYPES AND SIZES OF SHIPS EMPLOYED IN PHOSPHATE ROCK SEA TRANSPORT

The normal practice in chosing the type of ship is to employ the largest ship available at the required time of shipment that can berth at the ports where phosphate rock shipments are to be loaded and discharged. The size of ship, however, is normally determined by the volume of trade, the length of trip, the value of product, and the number of visits to the ports in question.

Shippers, however, often rely on a variety of ship types. One type utilized in phosphate rock world trade is the single-deck bulk carrier which is being increasingly employed on medium and long haul routes. This type of ship is well known for shipments for North and West Africa, Florida and the Pacific Islands. Ships of this type are normally available for full shiploads of 20,000 tons and above. Another type is the tween-decker. It is multi-purpose in design and operation, and is popular with certain charterers, notably the Chinese. It is also frequently used in transporting phosphate rock from Morocco. Although normally under 15,000 D.W.T., ships of this type with 20,000 D.W.T. and over, have recently been introduced into the market.

Statistics indicate that the average size of ship utilized in transporting phosphate rock has been rising progressively at an even higher rate than that of other major trades (Appendix IV. A)[1]. Almost half of

1. On many routes, shipping distances are less than 2,000 miles. However, the average shipping distance for phosphate rock transport is 3,600 miles due to the large-scale shipments from Florida and North Africa to the Asian markets.

the total tonnage of phosphate rock shipped during the period 1968-1973 was carried by smaller, multi-deck ships (Appendix IV. B.). Larger vessels have gradually increased their share of world shipments of phosphate rock. Their share of Moroccan shipments rose from 4 percent in 1965 to 34 percent in 1973. Meanwhile, their share in handling shipments of phosphate rock from Florida had increased from 24 percent in 1965 to 85 percent in 1973.[1] It is noteworthy that the average size of ship loading at Tampa or Jacksonville (United States), however, is very much higher than that in the North African phosphate rock trade, reflecting the rapid turn-round and longer shipping distances.

The pattern of trade by principal phosphate rock loading areas in 1971, indicates the dependence on smaller ships to handle phosphate rock shipments. Nevertheless, ships of 20,000 D.W.T. and over handled about 70 percent of total phosphate rock shipments from Tampa (United States) and other United States terminals.[2] In 1966, however, they handled only 30 percent. Ships of 20,000 D.W.T. and below handled about 54 percent of shipments from Florida to Japan, the largest single market for Florida phosphate rock.[3] To effect economies, bulk carriers were introduced into the Florida phosphate rock trade in spite of the draught at Tampa making it difficult for bulk carriers to load a full dead weight cargo. Table IV.10 reveals that bulk carriers handled about 51 percent of phosphate rock shipments from West Africa to Western Europe in 1971. Moreover, Table IV.11 shows that in 1971 India received 36 percent of its phosphate rock imports in ships of less than 10,000 D.W.T., 30 percent in ships of 10,000-20,000 D.W.T. and 34 percent in ships of over 20,000 D.W.T.. Therefore, bulk

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1. See, Table IV. 7.
2. See, Table IV. 8.
3. See, Table IV. 9.

TABLE IV. 7.

The Size Distribution of Ships in the Moroccan and Florida Phosphate Rock Trade (in percentages)

Year	Morocco		Florida	
	Size Group in D.W.T.		Size Group in D.W.T.	
	Under 18,000	Over 18,000	Under 18,000	Over 18,000
1965	96	4	76	24
1966	94	6	68	32
1967	82	18	54	46
1968	78	22	36	64
1969	77	23	41	59
1970	78	22	31	67
1971	78	22	29	71
1972	67	33	26	84
1973	66	34	15	85
1975	60	40		
Percentage Change 1973/1965	- 31.3	+ 750	- 80.3	+ 254
Percentage Change 1975/1965 For Morocco	- 37.5	+ 90		

Source: Fearnley and Eger, World Bulk Trade, 1973, (Norway).

TABLE IV. 8.

Sizes of Ship Transporting Phosphate Rock in 1971

(in Percentages)

Size Group	Under 10,000 D.W.T.	10,000/ 20,000 D.W.T.	20,000/ 30,000 D.W.T.	Over 30,000 D.W.T.
Algeria	57	43	-	-
Tunisia	63	37	-	-
Morocco	69	31	-	-
Senegal	44	44	12	-
Togo	22	10	6	62
Florida	8	21	37	34
Jordan	85	15	-	-
Nauru	5	33	62	-
Ocean	-	100	-	-
Christmas Islands	30	28	42	-

Source: International Superphosphate Manufacturers'Association (ISMA), 1972.

TABLE IV. 9.

Sizes of Ship Transporting Florida Phosphate Rock in 1971

(000 Tons and percentage of each Trade Area)

(000 D.W.T.)

Size Group Destination:	Under 10	%	10/20	%	20/30	%	Over 30	%
Western Europe	115	3	545	13	1671	39	1927	45
Canada	-	-	243	18	619	45	516	37
Central & S. America	355	25	237	17	631	45	180	13
Near East*	-	-	-	-	143	100	-	-
Indian Ocean	-	-	32	11	96	34	159	55
Japan	80	4	1026	50	442	22	501	24
Other Far East	5	1	115	15	296	39	346	45
Total Shipped	555	5	2197	21	3898	38	3630	36

* Iran (Bandar Shahpur)

Source: ISMA, 1972.

TABLE IV. 10.

Sizes of Ship Transporting West African Phosphate Rock in 1971

(000 Tons and percentage in each Trade Area)

(000 D.W.T.)

Size Group Destination:	Under 10	%	10/20	%	20/30	%	Over 30	%
Western Europe	637	25	634	24	238	9	1091	42
Eastern Europe	8	38	14	62	-	-	-	-
Near East*	48	82	11	18	-	-	-	-
Japan	207	95	11	5	-	-	-	-
Total	900	31	670	23	238	8	1091	38

* Iran (Bandar Shahpur)

Source: ISMA, 1972.

TABLE IV. 11.

Sizes of Ships Transporting Phosphate Rock to India in 1971

(Percentage of Imports)

Exporter	Size of Ship			
	Under 10,000 D.W.T.	10,000/ 20,000 D.W.T.	20,000/ 30,000 D.W.T.	Over 30,000 D.W.T.
Jordan	68	32	-	-
Morocco	85	15	-	-
Tunisia	25	75	-	-
Senegal	-	100	-	-
United States	-	11	24	55
Total Imported	37	30	12	21

Source: ISMA, 1972.

carriers were responsible for handling about one third of India's imports of phosphate rock in 1971.

C. PARTICULAR LIMITATIONS AT LOADING AND DISCHARGING PORTS

The high dependence on small ships in seaborne phosphate rock trade is partly explained by various factors imposing physical limitations on both loading and discharging ports, which rarely permit the economic use of ships of 20,000 D.W.T. and over.[1] Facilities are gradually being improved at major loading and discharging ports, although improvement programmes face problems with high costs of dredging the berths or approach channels, the installation of modern handling equipment and the provision of sufficient covered storage.

Another type of problem emerges from the fact that many phosphate rock cargoes move directly to consuming plants located at or near tidal waters. The berths available to such plants and the facilities available to them are often obsolete. They were initially designed to handle only small consignments of phosphate rock. The modernisation of these berths requires heavy investment which in many cases cannot be justified because of the limited throughput of these plants.

D. PHOSPHATE ROCK SEA TRANSPORT COSTS

Ocean transport costs represent a large element in the landed prices of phosphate rock. Sometimes, freight costs per ton exceed the F.O.B. value per ton of phosphate rock. Actual ocean freight costs per ton depend, however, on such factors as: the shipping distance; the type and size of ship employed; and the way the shipping space is secured.

Detailed data on freight rates for phosphate rock shipments, however, is hard to obtain for it is usually regarded as confidential.

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1. See, Appendix IV. C. and IV. D.

The rates charged may not bear much relation to the average costs of shipping, but they do provide at least an indication of developments in the freight market as a whole and of route differentials in particular.

The limited information published concerning the terms of transport and freight cost contracts indicates that freight rates have generally increased over the last decade. The average annual recorded tramp freight for phosphate rock from Florida to the Mediterranean area was about U.S.$ 5 per ton is 1963 and varied between U.S. $4.50 and U.S. $ 8 per ton between 1963 and 1969.[1] Rates from Tampa to Japan averaged U.S. $ 10 per ton and from Florida to Brazil they ranged from U.S. $7.50 to U.S. $ 10.25 per ton during the same period.[2]

The evolution of single voyage freight rates from Aqaba, Tampa and Casablanca to India, shown in Appendix IV. E reveals the depressed freight market in early 1971 which continued through to the second half of 1972 when a sustained upward movement in charter rates was realized and continued until mid-1974. The freight rate from Tampa to Japan, however, rose substantially by late 1973. It ranged between U.S. $ 35 and U.S. $ 40 per ton.[3] Meanwhile, the freight rate between Tampa and European destinations stood at between U.S. $ 20 and U.S. $ 25 per ton.[4] Recently, however, freight rates of about U.S. $ 15 per ton were announced for small consignments from Casablanca to East European destinations and U.S. $ 4 per ton for small shipments from Casablanca to Spanish ports.[5] In early 1975, a shipment of Moroccan phosphate rock from Safi to southern Brazil

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1. Kingdom of Jordan, JPMC, Sales and Marketing Department.
2. Ibid.,
3. H.P. Drewery, op. cit., p. 53.
4. Ibid., p. 53.
5. Kingdom of Jordan, JPMC, Marketing and Sales Department, op. cit.

was recorded at U.S. $ 30 per ton.[1]

On the other hand, by mid-1972, spot ocean freight for Florida and Casablanca was U.S. $ 10 per cargo ton, whilst it was U.S. $ 5 per cargo ton for Jordan.[2] By mid-1974 rates were U.S. $ 30, U.S. $ 45 and U.S. $ 20 per cargo ton for Florida, Casablanca and Jordan respectively.[3] Differences in the rates are explained by differences in cargo sizes, charter terms, canal dues, and shipping distances.

Appendix IV. E shows that the increase in the freight rate from Casablanca to India was more significant than the increases from Florida and Jordan to India.[4] This is partly explained by the fact that the costs of loading the cargo on a fixed scale were included in the freight rates, and partly due to other port costs levied on the ships. The scale loading charge at Casablanca increased from U.S. $ 0.23 per ton in early 1972 to U.S. $ 0.25 per ton in early 1973 and to U.S. $ 0.55 per ton by the beginning of 1974.[5] The net result of such increases was that the freight rate between Casablanca and India increased six-fold between mid-1972 and mid-1974, peaking at U.S. $ 50 per ton.

The unit transport costs for phosphate rock are estimated in Tables IV. 12 and 13 by ship size and route. These costs are considered as per cargo ton and as per ton per mile. They are theoretical and not the freight charter rates. They are derived from the operating costs of a ship and include capital charges associated with the acquisition of the ship, the outgoings incurred in operating the ship at sea, and voyage expenses. It

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1. Ibid.

2. H. P. Drewery, op. cit., p. 53.

3. Ibid., p. 54.

4. The movement of spot freight rates for full cargoes in three of the main phosphate rock trade to India, namely from Aqaba (Jordan), Tampa U.S.) and Casablanca (Morocco) is taken to represent market trends in individual trades.

5. H. P. Drewery, op. cit., p. 53.

TABLE IV. 12.

Estimated Unit Transport Costs for Phosphate by Ship Size and by Route

SHIP SIZE (D.W.T.) / ROUTE:	12,000	15,000	25,000	35,000	60,000
	U.S. Cents per Ton/Mile				
AQABA to:					
Rotterdam (via Cape)	0.15	0.14	0.10	0.09	0.07
Rotterdam (via Suez)	0.27	0.26	0.20	0.17	0.15
Genoa (via Cape)	0.15	0.14	0.10	0.09	0.07
Genoa (via Suez)	0.45	0.43	0.34	0.31	0.27
Bombay	0.34	0.32	0.22	0.19	0.15
Visakhapatnam	0.23	0.22	0.16	0.13	0.11
Chiba	0.16	0.15	0.11	0.09	0.08
TAMPA to:					
Rotterdam	0.20	0.19	0.13	0.11	0.09
Genoa	0.19	0.18	0.12	0.11	0.09
Bombay (via Cape)	0.18	0.17	0.12	0.10	0.08
Bombay (via Suez)	0.21	0.20	0.15	0.13	0.11
Visakhapatnam (via Suez)	0.18	0.17	0.13	0.11	0.09
Visakhapatnam (via Cape)	0.16	0.15	0.11	0.09	0.07
Chiba (via Panama)	0.17	0.16	0.11	0.10	0.08
CASABLANCA to:					
Rotterdam	0.35	0.33	0.24	0.21	0.17
Genoa	0.45	0.43	0.32	0.28	0.22
Bombay (via Cape)	0.19	0.18	0.13	0.11	0.09
Bombay (via Suez)	0.29	0.27	0.21	0.18	0.15
Visakhapatnam (via Cape)	0.16	0.15	0.11	0.09	0.08
Visakhapatnam (via Suez)	0.22	0.21	0.16	0.14	0.11
Chiba (via Cape)	0.14	0.13	0.10	0.08	0.07
Chiba (via Suez)	0.17	0.16	0.12	0.10	0.09
EL AAIUN to:					
Rotterdam	0.22	0.21	0.15	0.13	0.11
Genoa	0.28	0.26	0.19	0.17	0.14
Bombay (via Cape)	0.18	0.17	0.12	0.11	0.09
Bombay (via Suez)	0.25	0.24	0.18	0.16	0.13
Visakhapatnam (via Cape)	0.16	0.15	0.11	0.09	0.07
Visakhapatnam (via Suez)	0.20	0.19	0.14	0.13	0.11
Chiba (via Cape)	0.14	0.13	0.09	0.08	0.06
Chiba (via Suez)	0.16	0.15	0.11	0.10	0.08

Source: H. P. Drewery Limited, Phosphate Rock Shipping Through the Port of Aqaba, Jordan, (London: 1975).

TABLE IV. 13.

Estimated Unit Transport Costs for Phosphate by Ship Size and by Route

SHIP SIZE (D.W.T.) / ROUTE:	12,000	15,000	25,000	35,000	60,000
	U.S. Dollars Per Cargo Ton				
AQABA to:					
Rotterdam (via Cape)	17.25	16.30	11.55	9.75	7.95
Rotterdam (via Suez)	9.95	9.50	7.30	6.50	5.60
Genoa (via Cape)	17.10	16.15	11.45	9.70	7.90
Genoa (via Suez)	8.10	7.80	6.15	5.60	4.90
Bombay	9.75	9.20	6.45	5.55	4.40
Visakhapatnam	9.70	9.15	6.40	5.50	4.40
Chiba	12.75	12.00	8.50	7.20	5.90
TAMPA to:					
Rotterdam	8.95	8.45	6.00	5.10	4.15
Genoa	9.80	9.25	6.55	5.60	4.50
Bombay (via Cape)	20.50	19.35	13.65	11.60	9.40
Bombay (via Suez)	19.70	18.70	13.70	11.95	9.95
Visakhapatnam (via Cape)	19.30	18.25	12.90	10.90	8.85
Visakhapatnam (via Suez)	19.25	18.30	13.40	11.60	9.75
Chiba (via Panama)	14.90	14.10	10.20	8.74	7.15
CASABLANCA to:					
Rotterdam	5.10	4.80	3.55	3.10	2.45
Genoa	4.70	4.40	3.25	2.90	2.30
Bombay (via Cape)	17.80	16.75	11.90	10.15	8.20
Bombay (via Suez)	14.80	14.05	10.55	9.35	7.90
Visakhapatnam (via Cape)	16.40	15.50	11.00	9.35	7.60
Visakhapatnam (via Suez)	14.15	13.50	10.10	8.90	7.55
Chiba (via Cape)	19.10	18.05	12.85	10.90	8.90
Chiba (via Suez)	17.20	16.30	12.10	10.50	8.90
EL AAIUN to:					
Rotterdam	4.75	4.50	3.30	2.85	2.30
Genoa	4.80	4.50	3.30	2.90	2.30
Bombay (via Cape)	16.25	15.30	10.85	9.25	7.50
Bombay (via Suez)	14.70	13.95	10.50	9.20	7.80
Visakhapatnam (via Cape)	14.95	14.10	10.00	8.50	6.90
Visakhapatnam (via Suez)	14.25	13.55	10.10	8.90	7.55
Chiba (via Cape)	17.55	16.55	11.80	9.95	7.95
Chiba (via Suez)	17.10	16.25	12.05	10.45	8.85

Source: H. P. Drewery Limited , Phosphate Rock Shipping Through the Port of Aqaba, Jordan, (London: 1975).

should be noted that the unit transport cost per ton on the routes indicated, decreases substantially when the size of ship is increased and the distance is reduced.

Finally, Appendices IV. F and IV. G show the charges levied by port authorities or those providing services within ports for tweendeck ships of 15,000 D.W.T. They indicate that charges did vary significantly from port to port, and sometimes amounted to as much as U.S. $ 1 per ton. Nevertheless, such costs are only a small part of total costs compared with those associated with lengthy delays at ports.

PART FOUR: DEVELOPMENTS IN PHOSPHATE ROCK WORLD TRADE (1964-1974)

Trading of goods and services between nations is a phenomenon which has endured for thousands of years. Incentives to take part in trading activities include: surplus production; political motives; and humanitarian motives.[1] Since the economics of world trade are important, therefore, the cultural, technological and political consequences of trade benefit both individuals and nations. Individuals benefit through their ability to purchase a higher standard of living, and nations benefit through using their skills and resources at the highest possible level of productivity. In short, goods that cannot be produced domestically can be obtained from abroad and goods that can be produced domestically can be obtained from abroad at lower costs. Therefore, international trade is simply the extension of trade beyond the boundaries of a nation and it widens the range of specialisation and the gains to be derived from that.

Although many countries produce phosphate rock, only a few are net exporters. Data on phosphate rock world exports, unlike those on phosphate rock world consumption, are scant, unsystematic, fragmented and dispersed in many sources.

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1. John M. Hesse and Philip R. Cateora, op. cit., pp. 39-40.

World exports of phosphate rock averaged 46.7 percent per year of the total yearly world output during the period 1964 to 1974. Meanwhile, the average annual rate of growth during the same period was 10.8 percent (see,Table IV. 14)

Phosphate rock export trade, like phosphate rock production, is dominated by the activities of the three main producers, namely the United States, Russia and Morocco. Together, they accounted for about 70 percent of total world exports of phosphate rock in 1974.[1] This is a measure of the oligopolistic market structure that characertises the phosphate rock world industry which has a concentration ratio as high as 70 percent.

Morocco is by far the largest exporter with an average annual share of 31.4 percent during the ten years, 1964-1974. However, her share varied from as low as 27 percent in 1968 to as high as 39.8 percent in 1964. The United States was responsible for an average of 26.9 percent per annum of world exports during the same period, thus occupying the second position. Its share, however, ranged between 22.6 percent in 1964 and 29.2 percent in 1968. Other main exporters include Russia, Tunisia, Togo, Nauru, Senegal,and Jordan. Smaller exporters include: Spanish Sahara, South Africa, Syria, the United Arab Republic, Israel, Mexico, Christmas Island, and Ocean Island.Together,they exported about 6 million tons in total in 1974.

The regional pattern of trade in phosphate rock is apparent from Appendix IV. I. One of the main reasons for such regionalisation has been the relatively low value of phosphate rock, which in turn has resulted in fairly low average transport distances. The trade pattern has not significantly altered recently, although phosphate rock world prices have risen dramatically, as have the freight rates. This situation, therefore, continues to give incentives for consumers to purchase their supplies of phosphate rock locally wherever possible.

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1. British Sulphur Company Ltd., Statistical Supplement No. 11, (London: May/June 1975).

TABLE IV. 14.

Ratios of Exports from Main Producing Countries to World Exports of Phosphate Rock, 1964-1974

Year	Morocco	United States	Tunisia	Togo	Jordan	Israel	Senegal	Ratio of World Exports To World Production	Percentage Change in World Exports
1964	39.8	22.6	8.3	3.1	2.5	0.7	2.8	57.8	+ 2.7
1965	36.6	26.3	8.8	3.8	2.3	1.2	3.2	41.4	+10.9
1966	31.7	28.9	8.3	3.8	2.6	1.6	3.7	39.7	+13.0
1967	28.5	28.4	6.8	3.4	2.7	1.4	2.5	43.7	+14.3
1968	27.0	29.2	6.6	3.6	2.6	2.0	2.6	46.3	- 2.1
1969	28.0	27.9	5.1	4.0	2.5	2.4	2.5	46.6	+ 5.8
1970	29.2	27.3	5.4	3.9	1.7	2.0	2.7	47.3	+ 4.8
1971	29.2	28.2	5.9	4.3	1.6	1.4	3.1	48.2	+ 7.0
1972	31.2	28.7	5.3	4.3	2.2	1.5	3.6	47.8	+13.0
1973	32.8	25.7	4.3	4.7	2.2	1.1	3.4	49.6	+13.3
1974	33.5	23.2	4.3	4.7	2.6	1.3	3.2	47.6	
Average Ratio (1964-74)	31.4	26.9	6.4	4.0	2.3	1.5	3.0		
Average Annual Growth (1964-1974)									+ 10.8

Source: Appendix IV. H.

A. PHOSPHATE ROCK MAIN EXPORTING COUNTRIES

Morocco ranks first as an exporter of phosphate rock.[1] Its exports averaged 33.5 percent annually of total world exports of phosphate rock during the period 1964 to 1974. Exports from Morocco rose during the same period by 90 percent from 10.0 million tons in 1964 to 19 million tons in 1974. Nevertheless, its contribution to total world exports decreased from 39.8 percent in 1964 to only 27 percent in 1968. However, it rose again to reach 33.5 percent in 1974. Thus, Morocco's exports grew at a yearly average of 7.7 percent over the period 1964 to 1974. In 1974, the main market for Morocco's phosphate rock in Western Europe were: France, importing 2.4 million tons or 20.9 percent of the 11.5 million tons Morocco exported to Western Europe, or equivalent to 61.5 percent of her total exports, Britain and Belgium each imported 1.5 million tons, or 13 percent of the total Moroccan exports to Western Europe; Italy imported 1.4 million tons, or 12.2 percent of the total; and Spain imported 1.1 million tons, or 9.6 percent. Morocco's exports to Eastern Europe totalled 4.6 million tons in 1974, or 24.6 percent of total Moroccan exports. This market for Morocco has been growing in importance because of its transport advantages over the other competitors and also because of the increased demand. The main customers in this market were: Poland, receiving 1.8 million tons; Yugoslavia, about 1 million tons; Roumania, about 926,000 tons; Czechoslovakia, about 292,000 tons; and Bulgaria receiving about 287,000 tons. The remainder of Morocco's exports of 1974 (2.6 million tons, or 13.9 percent of the total), however, were sent to a variety of markets including: China, 222,000 tons; Brazil, 543,000 tons; Mexico, 665,000 tons; India, 264,000 tons; and Japan 631,000 tons. The combination of high grade phosphate rock, cheap labour, efficient mining methods, and proximity to the great markets in Europe has enabled Morocco to attain its position

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1. See, Appendix IV. I.

of dominance over the world phosphate rock industry. It seems very likely that she will maintain that position for some years to come.

The second largest exporter is the United States, although it is the largest producer of phosphate rock. This is because the United States consumes domestically about two-thirds of its annual output in fertilizer industries and the preparation of other chemicals needed for industry and agriculture. Between 1964 and 1974 the United States exported an average of 26.9 percent per year of total world exports of phosphates. Its share grew at a yearly average of about 9 percent. It rose from 7.5 million tons in 1964 to 12.9 million tons in 1974, or a rise of 72 percent. In 1968, however, United States exports reached a peak with some 29.2 percent of the world phosphate rock total exports, thus ranking first on the export list. However, the United States was not able to maintain this position and its share of world exports had fallen to 23.2 percent by 1974. It is noteworthy that the United States perhaps has the most diversified market. Of the 12.9 million tons exported in 1974, 3.8 million tons, or 29.5 percent went to Western Europe. A further 3.6 million tons, or 27.9 percent were shipped to the Asian markets, including Japan and South Korea. Canada received about 3.5 million tons (27.1 percent) and Latin America 1.7 million tons, or 13.2 percent. Eastern Europe, however, only received 303,000 tons, the majority going to Poland and Roumania. The reason for such a diversified market is attributed to factors such as:[1] the relatively high freight costs; and the ability of American prducers to expand their production capacity to meet world market requirements and to introduce competitive marginal pricing policies in depressed world market conditions.

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1. Robertson Research International Limited, op. cit., p. 71.

Another important phosphate rock exporter is Russia. Its exports are mainly shipped to Western and Eastern Europe. In 1974, West European markets received some 2.5 million tons from Russia, while Eastern Europe received some 4.1 million tons. The main Russian phosphate rock importers in Western Europe in 1974 were: West Germany, 875,000 tons; Finland, 490,000 tons; Norway, 290,000 tons; Belgium, 280,000 tons; and Spain 200,000 tons. In Eastern Europe, however, the main importers were: East Germany and Poland which each imported 2.2 million tons; Czechoslovakia, Hungary and Roumania all imported some 1.9 million tons, distributed evenly among these three countries. Although Russia is considered to be the most important single supplier of phosphate rock to Eastern Europe, its share in this market declined from 62 percent to 38.8 percent between 1968 and 1974.

Tunisia is another major exporter of phosphate rock. The level of her exports is relatively stable, averaging about 2 million tons a year. The increase in exports during the period 1964 to 1974 was only 13.7 percent. It reached 2.4 million tons in 1974. In 1964 Tunisia had 8.3 percent of world exports of phosphate rock and 4.3 percent in 1974. This gives an average share of 6.4 percent per annum for the period 1964 to 1974. The distribution of its 1974 exports indicates that West Europe received the bulk of these exports, accounting for 58.3 percent of Western European imports of phosphate rock. Tunisia also exported about 752,000 tons to Eastern Europe. Small quantities were also sent to Brazil and Uruguay.

Among the other important exporters in Africa are Togo and Senegal who exported some 2.6 million tons and 1.8 million tons in 1974, respectively. Of the Togolese exports, about 2.4 million tons went to markets in Western Europe, mainly to France and the Netherlands. Outside Europe, Togolese markets included Japan and Pakistan. Senegal, on the

other hand, exported 1.6 million tons to Western Europe, mainly to the Netherlands, Britain, France, and Greece.

Exporters such as the United Arab Republic, Jordan, Syria and Israel provided Asian markets with phosphate rock. However, the pattern of exports does vary among these exporters and at the same time reflects the importance of having access to specific seaboards.

B. PHOSPHATE ROCK MAIN IMPORTING COUNTRIES

Shipments of phosphate rock in general tend to move from developing to developed countries, which process the phosphate rock for domestic use and for re-export to developing countries.

During the period 1964 to 1974, France ranked first among phosphate rock importing countries. She imported an average of 10.1 percent per year of total world exports during this period. Imports by France grew by 132 percent, or from 2.5 million tons in 1964 to 5.8 million tons by 1974.

The second rank was occupied by Japan which imported an average of 8.1 percent per year of total world exports of phosphate rock over the period 1964 to 1974. Her imports grew from 2.3 million tons in 1964 to 3.9 million tons in 1974, an increase of 69 percent.

Imports by West Germany rose by 45 percent during the period 1964 to 1974 and reached 3.2 million tons in 1974. Her imports accounted for an average of 7.2 percent per year of total world exports of phosphate rock.

The greatest increase in imports of phosphate rock during the same period was shown in Poland with an increase of 433 percent, or from 549,000 tons to 2.6 million tons.

The other main phosphate rock importers and their average ratios and quantities of their imports are shown in Appendix IV. J.

PART FIVE: SUMMARY AND CONCLUSION

(i) Patterns of distribution and marketing practices, once established, usually persist for considerable periods of time. They play an important role in defining the nature of the price-making process and in determining the character of the responses of firms to changes in supply and demand. Sales of phosphate rock are usually made directly to domestic consumers. However, in export markets they are made through agents, brokers or other middlemen. Phosphate rock sales are effected on F.O.B., C.I.F. or F.A.S. bases and through contracts which usually extend over one year or more.

(ii) Prices of phosphate rock are usually quoted on a per ton basis of B.P.L. or T.C.P. content in percentage. They are declared as list prices. The list, however, serves only as a basis for negotiating the actual selling prices. Phosphate rock prices have been relatively stable except for the years 1973 and 1974 when substantial price increases were realized as a result of the uncertain market situation of the world phosphate rock industry. In 1975, however, prices of phosphate rock did decline and there was an excess of supply. In the foreseeable future, prices can be expected to lie in the range of the 1975 prices. The pricing policies of phosphate rock producing countries generally followed the lead of Morocco. Producing countries have sometimes resorted to cartel in an effort to cut down the intense competition and to bring back the balance to the market. The two known cartels were the 'Amophos' and the 'Phosrock'. However, in view of the world market situation of phosphate rock, it is expected that a major cartel might emerge to include all main phosphate rock producing countries.

(iii) The geographical concentration of phosphate rock production and the widely dispersed location of its primary consumers make the distribution of phosphate rock from producing to consuming areas an

important feature of the industry's market structure. Phosphate rock is usually transported in bulk either as full shipments or as part-cargo. The size and type of ship utilized, however, is governed by economic rather than technical considerations. Ocean transport generally depends on smaller ships due to the short distances involved, the general physical limitations characterising ports and the limited availability of equipment for phosphate rock handling at ports of export or import. However, the average size of ship utilized has grown progressively compared to the growth of the sizes of ship utilised in other trades. Furthermore, this chapter has demonstrated that ocean transport costs are thought to represent a large element in the landed price of phosphate rock.

(iv) Finally, it is noted that world phosphate rock trade, like world phosphate rock production, is dominated by the United States, Morocco and Russia. Together they accounted for about 70 percent of the world total phosphate rock exports in 1974. The phosphate rock market is more balanced on the imports side because no one consuming country can influence the price of phosphate rock. There is a wide range of importing countries throughout the world, with no one country importing more than 11 percent annually of the total world exports of phosphate rock.

CHAPTER FIVE: GROWTH TRENDS IN THE JORDANIAN ECONOMY AND GOVERNMENT INTERVENTION

PART ONE. THE ECONOMY PRIOR TO 1954

Between the sixteenth century and the end of the First World War, the territory occupied by Jordan formed part of the Ottoman Empire. In 1918, when Turkey was defeated, Great Britain became responsible for the region under a mandate from the League of Nations. Under British administration, the area was divided in 1923 into the territories of Palestine, west of the Jordan River, and Transjordan to the east of the river. In 1946, the British mandate of Transjordan ended and the territory became known as the Hashemite Kingdom of Transjordan. In 1948, Israel, an independent state, was created in most of the Palestinian land and the remaining part of Palestine was absorbed into Transjordan. In 1950, the enlarged Transjordan was renamed as the Hashemite Kingdom of Jordan.

In the early 1940's, Transjordan covered an area of 89,000 sq. km. with a population of between 300,000 and 350,000 divided into sedentary, semi-nomadic, and fully nomadic groups.[1] The sedentary population, numbering between 130,000 and 150,000 was only found in the south and northwest areas of the country. The semi-nomadic population, numbering about 140,000, was organised in tribal groupings and lived in tents. Besides their pastoral activities, they cultivated land and occupied the highland areas around Amman and southwards towards Ma'an. The nomads, numbering about 45,000, lived throughout the country and depended entirely on their flocks of sheep and goats and herds of camels. They undertook seasonal migration in search of pastures.

During the period of the British mandate, commercial activities in

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1. Oddrar Aresvik, The Agricultural Development of Jordan, (New York: Praeger Publishers, 1976), p. 1.

Transjordan were limited. The majority of the population depended upon subsistence arable farming or nomadic pastoralism. The total cultivated area was estimated at 445,000 h.a. and was concentrated in the highlands of the northwestern part of the country. Of the total area, only 13 percent was cultivable, 7 percent of which constituted irrigated land.[1] The main winter cereals were wheat and barley which were often grown in conjunction with leguminous crops such as kersennah, peas, and lentils, while the main summer crop was durra, a form of millet. Fruit cultivation was more important on the slopes overlooking the Jordan Valley with vineyards being common in areas around Salt and Ajlun. Within the Jordan Valley, bananas and other tropical fruits were grown under irrigation. Throughout the country, livestock formed an essential part of the agricultural economy.

Examination of the mineral and manufacturing activities of the country shows that manufacturing activities were practically non-existent. They were confined to two small tobacco factories in Amman, and three small distilleries near Salt. Tailoring and dyeing activities were common and important in larger towns of the country. Some processing of agricultural products did take place; for example samne, a clarified butter was manufactured and rugs and sacks were produced from the locally raised wool and hair. As for the mineral activities, no mines were working at that time, but huge quantities of phosphates and salts had been proved to exist. The only other mineral activity was the local quarrying of limestone, marble, and the sporadic digging of salt deposits in the El-Azraq area.

Therefore, as a result of the low level of economic acitivty, little

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1. Hanna S. Odeh, Economic Development of Jordan, 1954-1971, (Amman: The Jordanian Press Foundation, 1972), p. 2.

trade passed through the country's frontiers. Exports consisted mainly of agricultural products such as wheat, barley and fresh fruits, whereas imports included textiles, sugar, petroleum, rice, and kerosene.

PART TWO: GROWTH IN POPULATION AND LABOUR FORCE

A. POPULATION GROWTH

With the de facto partition of Palestine and the unification of the West Bank with the territory of Transjordan, the area of Jordan rose by 10 percent to reach about 97,000 sq. km.[1] Furthermore, the Jordanian population grew by 130 percent from 375,000 persons in 1946 to 1.1 million in 1952.[2] The large increase in population can be attributed to the estimated 350,000 refugees who fled to the West and East Banks from the part of Palestine which became Israel in 1948, and to the 460,000 persons who were already residents of the West Bank. Table V. 1 reveals that the population of Jordan grew at an annual average of 3.1 percent during the period 1954 to 1966 and at an annual average of 3.45 percent during the period 1967 to 1975.[3] It rose from 1.39 million in 1954 to 2.01 million in 1966 and about 2.73 million in 1975.[4] Population, however, is markedly concentrated in a very small area with densities of about 190 people per sq. km.[5] After the 1967 June War, another 200,000 refugees fled to the East Bank, making a bad situation even worse. The massive increases in population after the 1948 war and the 1967 June War, were not accompanied

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1. Hannah S. Odeh, Ibid., p. 1.

2. United Nations, Food and Agriculture Organisation, Jordan: Country Report, (Rome: 1967), p. 3.

3. The Jordanian population grew by 57 percent in the period 1947 to 1952 and 15 percent in the period 1966 to 1969 for the East Bank.

4. Population in the East Bank rose from 1.06 million in 1966 to 1.9 million in 1975.

5. United Nations, Studies on Selected Development Problems in Various Countries in the Middle East, (New York: U.N. Publications, 1969), p. 56.

TABLE V. 1.

Percentage Changes in Jordanian Population and Per Capita Income

1954 to 1975

Year	Percentage Change in Population	Percentage Change in Per Capita National Income
1954	-	-
1955	3.6	- 8.2
1956	2.8	33.8
1957	3.4	- 1.1
1958	3.3	6.6
1959	3.8	23.8
1960	3.1	3.5
1961	1.2	18.9
1962	3.5	- 0.5
1963	2.8	2.3
1964	3.3	13.0
1965	3.7	8.4
1966	3.1	- 0.2
1967	3.5	7.1
1968	3.4	- 7.3
1969	3.7	14.2
1970	3.6	- 8.1
1971	3.03	3.2
1972	3.8	7.1
1973	3.6	6.9
1974	3.1	24.5
1975	3.4	- 3.5
Average (1954-1966) Change	3.1	8.4
Average (1967-1972) Change	3.5	2.7
Average (1973-1975) Change	3.4	9.3
Average (1954-1975) Change	3.3	6.8

Source: Appendix V. A.

by adequate growth in the country's meagre natural and capital resources, employment and investment opportunities or technical progress. Consequently, the Jordanian economy faced a number of serious population problems such as: a situation of surplus labour; heavy pressures on educational, health and social services particularly since 52 percent of the population was under 15 years of age, causing a very high dependency ratio of 5:1; a low rate of economically active population (38 percent of the total population); and a relatively low participation rate of 22.9 percent of the total labour force (among women it was 10 percent).[1] Participation rates in Iraq, Syria and Lebanon were higher than in Jordan, being 28.3 percent, 26.3 percent and 31.7 percent respectively.[2] The low rate of participation in Jordan was caused by the low age profile of the population, the high rate of school enrolment, and the low female participation in the labour force.[3]

An important aspect related to population is the level of education. Proper education is considered to be the additional ingredient needed to accelerate growth rates since technological and social knowledge have great significance in promoting economic growth. In the late 1960's educated persons in Jordan accounted for about 32.4 percent of the adult population, of whom 8 percent were employed abroad.[4] It is important to note in this respect that Palestinian refugees affected positively the level of education in Jordan.

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1. The Kingdom of Jordan, The National Planning Council, The Five-Year Development Plan, 1976-1980, (Amman: The National Press, 1976), p. 25.

2. V. R. K. Tilak, A Review of the Manpower Situation in the Middle East, (Beirut: Memeo, 1969), p. 2.

3. The Kingdom of Jordan, The National Planning Council, The Manpower Situation in Jordan, (Amman: 1972).

4. United Nations, op. cit., pp. 56-61.

B. GROWTH OF THE JORDANIAN LABOUR FORCE

The population census of 1961 revealed that the Jordanian labour force numbered 390,000 persons or 22.9 percent of the total population, of whom 27,494 or 7.1 percent were unemployed.[1] By 1975, the labour force accounted for 19.6 percent of the total population and unemployment declined to 2.3 percent of the labour force.[2]

Between 1961 and 1975, there were significant changes in the distribution of the labour force between the different sectors of the economy. Table V. 2 shows that there was a substantial decline in the proportion of the total labour force working in agriculture. It declined from 38 percent to 18 percent, while employment in the services sector grew from 43 percent to 63 percent of the total labour force. Employment in the mining and manufacturing sectors, however, accounted for 19 percent of total employment in both years.

There is undoubtedly a large number of employees who are actually under-employed in the sense that their productivity is very low when compared with their levels of training and capacity. Furthermore, part of the Jordanian labour force is employed in some neighbouring Arab countries.[3] In 1961, these migrant workers numbered 60,000.[4] After 1973, a rapidly increasing demand for trained manpower was created by the rapid development in the Middle East region. As a result, Jordan suffered a drain on her trained personnel, particularly among technical and professional people

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1. The Kingdom of Jordan, Department of General Statistics, The Census of Population, 1961, (Amman: 1964).

2. Dr. M. Swaan, S. Gawi, F. Dajani, Population, Manpower, and Development in Jordan, (Amman: 1977), table 7.

3. The employment of Jordanians abroad at that time represented a brain drain and gave considerable elasticity to domestic labour supply. But in view of the scarcity of suitable domestic employment at that time, such employment was highly advantageous to the economy.

4. Charles A. Cooper and Sidney S. Alexander, (eds.), Economic Development and Population Growth in the Middle East, (New York: American Elsevier Publishing Company, Inc., 1972), p. 210.

TABLE V. 2.

Percentage Distribution of the Jordanian Labour Force Among the Economic Sectors for the Years 1961 and 1975

Sector	1961	1975	Percentage Growth Between 1961 and 1975
Agriculture	38	18	- 52.6
Mining and Industry	19	19	0
Services	43	63	46.5
	100	100	

Source: (i) Hannah S. Odeh, The Economic Development of Jordan, 1954-1971, (Amman: 1972), p. 2, for data of the year 1961.

(ii) Kingdom of Jordan, The National Planning Council, Five-Year Plan for Economic and Social Development, 1976-1980, (Amman: 1976), p. 50 for data for the year 1975.

who were attracted by the high wages offered by the oil-rich Arab states. This situation limited Jordan's ability to implement and manage her own economic and social development programmes. At present, it is estimated that one third of Jordan's labour force is employed outside the country. These migrants sent back JD 53.11 million and JD 136.41 million in 1975 and 1976 respectively. [1]

The Jordanian labour force is expected to grow by 32 percent between 1976 and 1980, assuming there is no change in the social structure.[2] Therefore, the economically active population will rise by at least 120,000 persons within that period.

As for the educational level of the labour force, the 1974 employment survey revealed that 62.3 percent of the total labour force had not finished their high-school level of education, 26.9 percent had just finished that level, and only 10.8 percent held university degrees.[3]

PART THREE: ECONOMIC STRUCTURE AND GROWTH TRENDS BETWEEN 1954 AND 1975

Social and economic growth are best assessed through tracing the growth in the Gross National Product (GNP), the Gross Domestic Product (GDP), or the Per Capita National Income (PCNI).

For a nation, economic growth means a sustained increase in the output of goods needed to satisfy human wants. Therefore, it implies major structural changes and correspondingly large modifications in social and institutional conditions under which the greatly increased product per capita is attained.[4] Throughout its existence, Jordan has experienced

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1. The Times, May 19th 1978, Jordan ready for the prize of Middle East Peace.

2. Kingdom of Jordan, The National Planning Council, op. cit., pp. 25-27.

3. Kingdom of Jordan, Department of General Statistics, The Employment Survey, 1974,(Amman: The National Press, 1975), pp. 1-3.

4. Simon Kuznets, Economic Growth (Chicago: Free Press of Glencoe, 1959), p. 13.

substantial variations in its social and economic activities. Improvements in the economy have often been severely set back by political difficulties. Therefore, the analysis will concentrate on developments during three distinct phases namely 1954 to 1966, 1967 to 1972 and 1973 to 1975.

A. ECONOMIC STRUCTURE AND GROWTH TRENDS BETWEEN 1954 AND 1966

In spite of the 1948 war and its consequences, Gross Domestic Product grew at an annual average rate of 10.8 percent from JD 47.7 million in 1954 to JD 149.5 million in 1966.[1] This relatively high growth in GDP took place within the framework of relative monetary and price stability. The level of prices rose at an annual average rate of 2 percent during the period, and population increased annually by 3.1 percent. Therefore, the rise in the per capita real income was about 5 percent per year during the period.[2] This relatively successful performance of the economy can be attributed to the high and rising level of private and public investment which resulted from the consequences of the 1948 War when it was essential to invest in infra-structural projects and to the expanded production in various economic sectors.

The contribution of the mining and manufacturing sector to GDP had been insignificant until 1952. However, during the period 1954 to 1966 this sector accounted for an annual average of 14.5 percent of GDP and grew by 5.3 percent per year.[3] The growth in the value added of this sector averaged 10.7 percent annually as a result of the establishment of

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1. See Table V. 3. and Appendix V. B.

2. The average annual growth of domestic product per capita between 1960 and 1968 for Jordan was 6.7, 4.6 for Lebanon, 4.1 for Syria, 4.3 for Egypt, 7.1 for Israel and 4.3 for Iraq. From United Nations, Statistical Yearbook, 1972 (New York: U.N. Publications, 1973), tables 137 and 186.

3. For detailed information about the relative importance of the economic sectors in GDP and their growth rates, see Tables V. 4. and V. 5.

TABLE V. 3.

Percentage Growth of the Value Added from the Economic Sectors, 1954-1966

Period	Agriculture, Forestry and Livestock	Mining, Electricity and Manufacturing	Construction	Transport	Trade and Banking	Ownership of Dwellings	Public Administration and Defence	Other Services	Gross Domestic Product at Factor Cost	Gross National Product (G.N.P.)
1954	-	-	-	-	-	-	-	-	-	-
1955	- 56.3	24.0	25.0	25.0	0	0	7.0	10.0	- 10.0	- 5.0
1956	206.5	21.2	13.3	24.0	13.0	26.0	19.0	- 18.2	42.3	37.6
1957	- 33.0	8.0	12.0	22.1	16.5	7.0	16.0	37.0	1.1	2.3
1958	1.0	11.8	26.3	8.4	20.0	6.5	17.3	5.4	12.0	10.0
1959	17.1	- 9.2	95.8	18.4	30.6	87.9	3.8	100.0	23.3	28.5
1960	- 3.3	10.1	- 4.3	3.7	8.5	14.5	5.3	6.4	4.9	6.7
1961	73.3	25.0	0	13.5	25.5	14.1	5.7	3.6	24.1	20.3
1962	- 17.4	- 7.4	37.8	- 1.0	- 2.0	6.2	2.4	10.5	- 2.1	2.9
1963	5.7	31.8	- 1.6	2.4	10.8	9.3	2.9	9.5	8.4	5.2
1964	54.3	17.2	- 9.8	- 6.3	6.1	5.3	11.9	7.7	15.1	16.7
1965	0	31.6	43.6	5.0	13.6	8.1	8.6	14.3	11.4	12.4
1966	- 19.1	7.3	17.7	14.3	- 5.4	4.7	2.8	10.2	- 1.0	2.9
Average 1954-1966	19.1	14.3	21.4	10.8	11.5	15.8	8.6	16.2	10.8	11.7

Source: Appendix V. B.

TABLE V. 4.

Percentage Contribution and Growth of Each Economic Sector to Gross Domestic Product, 1954-1966

Year	Agriculture, Forestry and Livestock		Manufacturing, Mining and Electricity		Construction		Transport		Trade and Banking		Ownership of Dwellings		Public Administration and Defence		Other Services		
	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	
1954	29.8	-	8.8	-	2.5	-	9.2	-	19.5	-	4.8	-	19.1	-	6.3	-	100
1955	14.4	- 51.7	12.1	37.5	3.5	40.0	12.8	39.1	21.6	10.8	5.3	10.4	22.6	18.3	7.7	22.2	100
1956	30.9	114.6	10.3	- 14.9	2.8	- 20.0	11.1	- 13.3	16.8	- 22.2	4.7	- 11.3	18.7	-17.3	4.7	- 39.0	100
1957	20.7	- 33.0	11.0	6.8	3.1	10.7	13.4	20.7	19.4	15.5	5.0	6.4	21.5	15.0	5.9	25.5	100
1958	18.7	- 9.7	11.0	0	3.5	12.9	13.0	- 3.0	20.8	7.2	4.8	- 4.0	22.6	5.1	5.6	- 5.1	100
1959	17.7	- 5.4	8.1	- 26.4	5.5	57.1	12.6	- 3.1	22.0	5.8	7.4	54.2	17.6	-22.1	9.1	62.5	100
1960	16.4	- 7.4	8.5	4.9	5.0	- 9.1	12.4	- 1.6	22.8	3.6	7.9	6.8	17.7	1.0	9.3	2.2	100
1961	22.8	39.0	8.6	1.2	4.1	- 18.0	11.4	- 8.1	23.0	1.0	7.3	- 7.6	15.0	-15.3	7.8	- 16.1	100
1962	19.2	- 15.8	8.1	- 5.8	5.7	39.0	11.5	1.0	23.2	1.0	7.9	8.2	15.7	4.7	8.7	11.5	100
1963	18.8	- 2.1	9.9	22.2	5.2	- 8.8	11.0	- 4.4	23.6	- 1.7	7.9	0	14.9	- 5.1	8.7	0	100
1964	25.1	35.5	10.0	1.0	4.1	- 21.2	8.9	- 19.1	21.8	- 7.6	7.3	- 7.6	14.5	- 2.7	8.3	4.6	100
1965	22.6	- 10.0	12.7	27.0	5.2	26.8	8.4	- 5.6	22.2	1.8	7.1	- 2.7	14.3	- 1.4	8.5	2.4	100
1966	18.5	- 18.0	12.8	1.0	6.2	19.2	9.6	14.3	21.3	- 4.1	7.5	5.6	14.7	- 2.1	9.4	10.6	100
Average Contribution 1954-1966	21.2	3.0	10.2	4.6	4.3	10.7	11.2	1.4	21.4	1.2	6.5	4.9	17.6	- 2.4	7.7	6.8	

Source: Appendix V. B.

TABLE V. 5.

Percentage Contributions and Growth of the Sectors of Mining and Industry, Agriculture, and Services to G.D.P., 1954-1966

Period	Mining and Industry * (Ratio to GDP)		Agriculture * (Ratio to GDP)		Services * (Ratio to GDP)	
	Ratio	% Change	Ratio	% Change	Ratio	% Change
1954	11.3	-	29.8	-	58.9	-
1955	15.6	38.1	14.4	-51.6	70.0	18.9
1956	13.1	-16.0	30.9	+114.6	56.0	-20.0
1957	14.1	7.6	20.7	-33.0	65.2	16.4
1958	14.5	2.8	18.7	- 9.7	66.8	2.5
1959	13.6	- 6.2	17.7	- 5.4	68.7	2.8
1960	13.5	- 1.0	16.4	- 7.4	70.1	2.0
1961	12.7	- 5.9	22.8	39.0	64.5	- 8.0
1962	13.8	8.7	19.2	-15.8	67.0	3.9
1963	15.1	9.4	18.8	- 2.1	66.1	- 1.3
1964	14.1	- 6.6	25.1	35.5	60.8	- 8.0
1965	17.9	27.0	22.6	-10.0	59.5	- 2.1
1966	19.0	6.2	18.5	-18.0	62.5	5.0
Average 1954-1966	14.5	5.3	21.2	3.0	64.3	1.0

Source: Appendix V. B.

* The Sector of Mining and Industry includes mining, manufacturing, construction and electricity sub-sectors. The Agricultural Sector includes crops, forestry and livestock sub-sectors. The Services Sector includes, however, the remaining sub-sectors of the economy, mainly transport, trade and banking, ownership of dwellings, public administration and defence, and other services.

new industries such as: cement, petroleum refining, and vegetable oil, and the expansion of existing industries, in particular the phosphate rock industry.[1] The services sector, on the other hand, contributed an average of 64.3 percent to GDP annually, and grew at only one percent per year although the value added generated in the services sector grew at an average of 12.6 per year. The agricultural sector, however, grew at 19.1 percent annually. Its contribution to GDP averaged 21.2 percent yearly during this period and grew at only 3 percent per year as a result of the poor weather that prevailed in most of the years between 1954 and 1961.[2] The growth in this sector is generally attributed to the expansion in production from irrigated areas after the completion of major irrigation projects such as the East Ghor Canal and to the better weather conditions in the rain-fed areas between 1961 and 1966.

The examination of total available resources during the period 1954 to 1966 reveals that such resources grew by an average of 10.8 percent annually, from JD 67.5 million to JD 226.1 million in 1966 (See Table V. 6, and Appendix E).[3] Gross Domestic Product was responsible for 67.6 percent of the total available resources, or an average of JD 94.7 million per year. The contribution of GDP to the total available resources of the economy can be regarded as a rough indication of the capacity of the economy to produce more output. Imports of goods and services accounted for the rest of total available resources. The resource-use pattern, meanwhile, indicates that aggregate consumption constituted an average

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1. See Appendix V. C, for production of principal industries between 1954 and 1975.

2. See Appendix V. D. for the Production of Principal Agricultural Crops, 1954-1975.

3. Total available resources, as defined in Jordanian National Accounts, are equal to GDP plus imports of goods and services. Uses of resources, however, include total consumption, exports of goods and services, gross capital formation, and variation in stocks.

TABLE V. 6.

Origin of the Resources and Their Use, 1954-1966

(in current prices and million Jordanian Dinars)

Year	Gross Domestic Product at Factor Cost (G.D.P.)		Imports of Goods and Services		Imports Minus Exports	Total Available Resources		Total Consumption			Gross Capital formation (G.C.F.)				Stock Variation	Exports of Goods and Services		Total of Use of Resources
	Value	Ratio to (T.A.R.)	Value	% of (T.A.R.)	Value	Value	% Change	Value	% Change	% of (T.A.R.)	Value	% Change	% of (T.A.R.)	% of (G.D.P.)	Value	Value	% of (T.A.R.)	Value
1954	47.7	70.7	19.8	29.3	13.7	67.5	-	59.1	-	87.6	5.9	-	8.7	12.4	- 3.6	6.1	9.0	67.5
1955	43.0	61.6	26.8	38.4	19.5	69.8	3.4	61.7	4.4	88.4	6.1	3.4	8.7	14.2	- 5.3	7.3	10.5	69.8
1956	61.2	72.5	26.2	27.5	16.8	87.4	25.2	69.7	13.0	79.8	13.7	124.6	15.7	22.4	- 5.4	9.4	10.8	87.4
1957	61.9	65.6	32.4	34.4	21.7	94.3	7.9	79.8	14.5	84.6	9.3	-32.1	9.9	15.0	- 5.5	10.7	11.4	94.3
1958	69.1	65.3	36.7	34.7	26.8	105.8	12.2	92.8	16.3	87.7	8.2	-12.0	7.8	11.9	- 5.1	9.9	9.4	105.8
1959	85.2	66.3	43.4	33.7	31.6	128.6	21.6	112.6	21.3	87.6	12.6	53.7	9.8	14.8	- 8.4	11.8	9.2	128.6
1960	89.4	65.5	47.1	34.5	34.3	136.5	6.1	115.5	2.5	84.6	17.1	35.7	12.5	19.1	- 8.9	12.8	9.4	136.5
1961	110.9	70.4	46.6	29.6	29.6	157.5	15.4	130.9	13.3	83.1	19.0	11.1	12.1	17.1	- 9.4	17.0	10.8	157.5
1962	108.7	67.7	51.8	32.3	32.7	160.5	1.9	131.4	0.4	81.9	20.2	6.3	12.6	18.6	-10.2	19.1	11.9	160.5
1963	117.8	65.9	61.1	34.1	40.8	178.9	11.5	149.8	14.0	83.7	20.0	- 1.0	11.2	17.0	-11.2	20.3	11.4	178.9
1964	135.5	70.5	56.7	29.5	32.1	192.2	7.4	155.8	4.0	81.1	25.3	26.5	13.2	18.7	-13.5	24.6	12.8	192.2
1965	150.9	70.3	63.6	29.7	35.1	214.5	11.6	174.8	12.3	81.5	77.8	10.0	13.0	18.4	-16.6	28.5	13.2	214.5
1966	149.5	66.1	76.6	33.9	44.5	226.1	5.4	187.7	7.0	83.0	28.1	1.1	12.4	18.8	-21.8	32.1	14.2	226.1
Average 1954-1966	94.7	67.6	45.3	32.4		140.0	10.8	117.1	10.3	84.2	16.4	18.9	11.4	16.8		16.0	11.1	140.0

Source: (i) R. S. Porter, Economic Trends in Jordan, 1954-1959, (Beirut: Middle East Division, July 1961), for data on years 1954-1959.

(ii) Jordan Department of Statistics, The National Accounts, 1959-1966, (Amman: Department of Statistics Press, n.d.), for data on the years 1956 to 1966.

of 84.2 percent per year of the total available resources. However, there has been considerable change in the pattern in the sense that more resources were channelled to economic and social development. The gross capital formation constituted 8.7 percent of total available resources in 1954 and rose to 12.4 percent by 1966, thus averaging 11.4 percent annually during the intervening period with a growth rate of 18.9 percent per year. Gross capital formation constituted an average of 16.8 percent per year of GDP during the same period. The share of exports of goods and services in the total available resources rose from an average of 9 percent in 1954 to an average of 14.2 percent in 1966.

During the period 1954 to 1966, the total revenue to the Central Government averaged JD 32.5 million per year.[1] It constituted an average of 21.7 percent of GDP annually and grew at an average of 6.8 percent yearly. Domestic revenue, however, accounted for 50 percent of total revenue and grew at an average annual rate of 15.3 percent. Meanwhile, external or foreign revenue grew at an annual average of 8.7 percent and averaged JD 16.3 million per year. About 85 percent annually of foreign revenue represented foreign aid to Jordan either as budget support (90.2 percent of total foreign aid) or as technical and economic assistance (9.8 percent). When compared to total revenue, foreign aid represented an average of 43 percent per year.

On the other hand, total government expenditure averaged JD 31.7 million annually and grew at an annual average of 7.8 percent. About 51.6 percent per year of total expenditure represented spending on defence and security which grew at an annual average of 5.8 percent and constituted an average of 51 percent annually of total revenue.[2] Table V. 7 reveals

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1. See,Table V. 7.

2. Expenditure on defence and security includes expenditure on services in this sub-sector.

TABLE V. 7.

Total Revenue and Expenditure of the Central Government, 1954-1966

(Values in Millions of Jordanian Dinars)

Period	Domestic Revenue			Foreign Revenue			Total Revenue (T.R.)		Total Foreign Aid (T.F.A.)		Budget Support			Technical and Economic Assistance			Total Expenditure		Defence and Security Expenditure				Deficit or Surplus
	Value	% Change	Ratio to T.R.	Value	% Change	% to T.R.	Value	% Change	Value	% Change	Value	% Change	% to T.F.A.	Value	% Change	% to T.F.A.	Value	% Change	Value	Ratio to T.R.	Ratio to T.E.	% Change	Value
1954	7.49	-	42.4	10.18	-	57.6	17.67	-	8.9	-	8.4	-	94.4	0.5	-	5.6	16.56	-	9.52	54.0	57.5	-	1.11
1955	7.98	6.5	42.3	10.88	6.8	57.7	18.86	6.7	9.3	4.5	9.0	7.1	96.8	0.3	- 40.0	3.2	17.63	6.5	9.68	51.3	55.0	1.7	1.23
1956	8.68	8.8	40.9	12.52	15.1	59.1	21.20	12.4	11.0	18.3	10.9	21.0	99.1	0.1	- 66.7	0.9	21.32	20.9	10.63	50.1	50.0	9.8	- 0.12
1957	19.20	121.2	75.2	6.32	-94.5	24.8	25.52	20.4	6.0	-45.5	5.0	-54.6	83.3	1.0	900.0	16.7	23.86	11.9	13.54	53.1	57.0	27.4	1.66
1958	10.88	- 43.3	35.5	19.72	212.0	64.5	30.60	20.0	18.6	210.0	16.4	228.0	88.2	2.2	120.0	11.8	29.34	23.0	13.42	44.0	46.0	- 1.0	1.26
1959	13.35	22.7	42.0	18.41	- 6.6	58.0	31.76	3.8	17.9	- 3.8	16.4	0	91.6	1.5	- 31.8	8.4	30.82	5.0	16.73	53.0	54.0	24.7	0.94
1960	13.84	3.7	43.4	18.06	- 1.9	56.6	31.90	0.4	17.5	- 2.2	16.4	0	93.7	1.1	- 26.7	6.3	32.84	6.6	18.06	57.0	55.0	8.0	- 0.94
1961	14.68	6.1	43.7	18.90	4.7	56.3	33.58	5.3	18.4	5.1	16.4	0	89.1	2.0	81.8	10.9	33.09	1.0	18.43	55.0	56.0	2.1	0.49
1962	21.11	43.8	54.3	17.74	- 6.1	45.7	38.85	15.7	15.6	-15.2	14.6	-11.0	93.6	1.0	- 50.0	6.4	37.62	13.7	18.72	48.2	50.0	1.6	1.23
1963	19.38	- 8.2	53.3	16.98	- 4.3	46.7	36.36	- 6.4	15.7	1.0	14.0	- 4.1	89.2	1.7	70.0	10.8	39.34	4.6	19.11	53.0	49.0	2.1	- 2.98
1964	23.83	23.0	51.6	22.38	31.8	48.4	46.21	27.1	15.4	- 1.9	13.7	- 2.1	89.0	1.7	0	11.0	43.63	10.9	21.61	47.0	50.0	13.1	2.58
1965	26.73	12.2	59.9	17.86	-20.2	40.1	44.59	- 3.5	15.2	- 1.3	12.8	- 6.6	84.2	2.4	41.2	15.8	46.99	7.7	22.21	50.0	47.3	2.8	- 2.40
1966	23.31	- 12.8	65.9	12.05	-32.5	34.1	35.36	-20.7	9.9	-34.9	7.9	-38.3	79.8	2.0	- 16.7	20.2	38.61	-17.8	17.12	48.3	44.3	-22.9	- 3.25
Average 1954-1966	16.19	15.3	50.0	16.29	8.7	50.0	32.48	6.8	13.8	11.2	12.5	11.6	90.2	1.3	81.8	9.8	31.67	7.8	16.1	51.1	51.6	5.8	0.81

Source: (i) Kingdom of Jordan, Annual Reports,1954-1966, (Amman: National Press, relevant years), for the years 1954-1966.

(ii) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletin, several issues, for the years 1964 to 1966 for data on defence and security expenditure.

that on average, the Government's budget had a yearly deficit of JD 0.81 million.

B. ECONOMIC STRUCTURE AND GROWTH TRENDS DURING THE PERIOD 1967 TO 1972

The rapid economic growth and social changes, experienced between 1954 and 1966, were interrupted by the 1967 June War and its consequences which included: the loss of the West Bank, an important market for industries in the East Bank; the suspension of a large number of projects from the Seven-Year Social and Economic Programme; the influx of approximately 300,000 refugees into the East Bank which added a heavy burden to an already over-strained economy; the disruption of the economic activities in the Jordan Valley; the suspension of the Kuwait and Lybian financial assistance in 1970, as a result of the conflict between the Jordanian Government and the Fedayeen; the sharp decline in income from tourism which fell from JD 11.3 million in 1966 to JD 3.1 million in 1971; and the closure of the Suez Canal, which made exports from Jordan to countries west of Suez and imports from such countries more expensive.

In addition to such problems, the Jordanian Government had to channel part of its resources from development projects into providing shelter, food, and employment for the refugees. Furthermore, the political uncertainty and tension discouraged local and foreign investors from undertaking investment. All these factors resulted in lower economic growth rates. GDP during this period grew at an annual average rate of 5.3 percent from JD 177.1 million to JD 224.2 million,[1] averaging JD 193.4 million per year. The price level, however, grew at an annual average rate of 5.0 percent, while population grew at an average of 3.5 percent annually. Therefore, income per capita decreased by 3.1 percent annually.[2]

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1. See, Table V. 8, and Appendix V. E.

2. In 1972, the Per Capita National Income stood at U.S. $ 276 for Jordan, U.S. $ 393 for Iraq, U.S. $ 210 for Egypt, U.S. $ 631 for Lebanon, U.S.$334 for Syria and U.S. $ 433 for Saudi Arabia. From United Nations, Statistical Yearbook, 1974, (New York: U.N. Publications, 1975), pp. 644-649.

TABLE V. 8.

Growth Trends in the Value Added from Economic Sectors, 1967-1975

(In Percentages)

Period	Agriculture, Forestry and Livestock	Mining and Manufacturing	Construction	Electricity and Water Supply	Transport	Wholesale and Retail Trade	Banking and Finance	Ownership of Dwellings	Public Administration and Defence	Other Services	Gross Domestic Product (G.D.P.)	G.N.P.
1967	-	-	-	-	-	-	-	-	-	-	-	-
1968	- 28.9	14.9	12.4	27.8	- 1.4	- 25.6	- 11.8	3.4	27.7	9.2	- 4.5	- 4.2
1969	32.0	14.9	11.2	- 8.7	9.6	32.0	40.0	4.1	9.3	10.2	17.8	18.5
1970	- 20.9	- 14.3	- 28.4	14.3	- 1.0	- 1.0	0	6.3	4.4	16.4	- 4.4	- 4.8
1971	31.7	4.0	- 3.9	12.5	1.9	2.6	19.1	5.9	2.9	3.3	6.9	6.3
1972	12.4	22.3	29.3	7.4	11.7	9.0	0	5.6	5.1	7.7	10.7	11.2
Average 1967-1972	5.3	8.4	4.1	10.7	4.2	3.4	15.8	5.1	9.9	9.4	5.3	5.4
1973	-	-	-	-	-	-	-	-	-	-	-	-
1974	70.9	71.7	11.1	5.7	27.1	15.6	11.8	9.4	10.5	18.4	29.0	28.4
1975	- 52.3	- 1.0	- 5.3	-16.2	- 1.6	- 15.6	13.2	- 10.3	2.4	- 1.0	- 12.7	0
Average 1973-1975	9.3	35.4	2.9	- 5.3	12.8	0	12.5	- 0.5	6.5	8.7	8.2	14.2

Source: Appendix V. E.

An examination of the contribution of the economic sectors to GDP reveals that the industrial sector accounted for an annual average of 16.8 percent of GDP while its contribution grew by 2.2 percent annually.[1] The value added generated by this sector averaged JD 32.6 million per year and grew by 23.2 percent annually from JD 28.0 million in 1967 to JD 37.8 million in 1972. The services sector, however, continued to contribute a high proportion to GDP, averaging 64.9 percent per year. Its contribution grew at only 1.0 percent annually. Income from this sector rose from JD 110.4 million in 1967 to JD 143.9 million, representing an average annual rise of 41.5 percent. On the other hand, the agricultural sector contributed an average of 18.3 percent annually to GDP with an average decline of 1.2 percent annually in its contribution. Income from this sector averaged JD 35.3 million.[2] It grew from JD 38.7 million in 1967 to JD 42.5 million in 1972, equivalent to a yearly average of 5.3 percent.

As shown in Table V. 11 , the total available resources of the country grew during this period at an annual average of 7.9 percent, from JD 240.8 million to JD 344.1 million. GDP, however, constituted an average of 67.4 percent of the total resources (an average of JD 193.4 million yearly), whereas imports of goods and services constituted an annual average of 32.6 percent of total resources. Therefore, it is clear that the picture has not changed significantly since 1954. Of the total resources, an average of 80.7 percent yearly was spent on aggregate consumption and an average of 11.3 percent on gross capital formation which grew at an annual average of 21.6 percent and constituted an average of 16.9 percent of GDP. Hence, more of the available

1. See Tables V. 9. and V. 10. and Appendix V. E.

2. To the best knowledge of the writer, allowance has been made for self-sufficiency in farming and other sub-sectors.

TABLE V. 9.

Percentage Contributions of Economic Sectors to Gross Domestic Product, 1967-1975

Period	Agriculture, Forestry and Livestock		Mining and Manufacturing		Construction		Transport		Wholesale and Retail Trade		Public Administration and Defence		Other Services		Ownership of Dwellings		Electricity and Water Supply		Banking and Finance	
	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change	Ratio	% Change
1967	21.9	-	9.8	-	4.9	-	8.4	-	22.1	-	14.7	-	8.6	-	6.7	-	1.0	-	1.9	-
1968	16.3	- 25.6	11.9	21.4	5.8	18.4	8.6	23.8	17.3	-22.7	19.7	34.0	9.9	15.1	7.3	9.0	1.4	40.0	1.8	- 5.3
1969	18.3	12.3	11.6	- 2.5	5.5	- 5.2	8.1	- 5.8	19.4	12.1	18.3	- 7.1	9.1	- 8.1	6.5	-11.0	1.1	-21.4	2.1	16.7
1970	15.1	- 17.5	10.4	- 10.4	4.1	-25.0	8.5	4.9	20.0	3.1	20.0	9.3	11.2	23.1	7.2	10.8	1.3	18.2	2.2	+ 4.8
1971	18.7	2 .8	10.2	- 1.9	3.6	-12.2	8.0	- 5.9	19.3	- 3.5	19.2	- 4.0	10.9	- 2.7	7.1	- 1.4	1.3	0	1.7	-22.7
1972	18.9	1.1	11.2	9.8	4.3	19.4	8.1	1.3	19.0	- 1.6	18.3	- 4.7	10.6	- 2.8	6.8	- 4.2	1.3	0	1.5	-11.8
Average 1967-1972	18.3	1.2	10.9	3.3	4.7	- 1.0	8.1	- 1.0	19.5	- 2.5	18.4	5.5	10.1	4.9	6.9	5.5	1.2	5.4	1.9	- 3.7
1973	13.4	-	12.0	-	6.6	-	8.3	-	18.8	-	20.1	-	10.9	-	6.9	-	1.6	-	1.4	-
1974	17.7	32.1	15.8	31.7	5.5	-16.7	8.2	- 1.2	16.9	-10.1	17.8	-11.4	10.0	- 8.3	1.0	-17.4	1.2	-25.0	1.2	-14.3
1975	9.7	45.2	18.0	13.9	6.6	9.1	9.2	12.2	16.3	- 3.6	20.8	16.7	11.4	14.0	1.8	7.8	1.2	0	1.6	33.3
Average 1973-1975	13.8	- 6.7	15.5	22.8	5.9	- 3.8	8.6	5.5	17.3	- 6.7	19.5	2.7	10.7	2.9	6.0	2.7	1.3	-12.5	1.4	9.5

Source: Appendix V.E.

TABLE V. 10.

Percentage Shares and Growth of Material Producing Sectors and Services Sector to Gross Domestic Product, 1967-1975

Period	Mining and Industry * (Ratio to GDP)		Agriculture * (Ratio to GDP)		Services * (Ratio to GDP)	
	Ratio	% Change	Ratio	% Change	Ratio	% Change
1967	15.7	-	21.9	-	62.4	-
1968	19.1	21.7	16.3	-25.6	64.6	3.5
1969	18.2	- 4.7	18.3	12.3	63.5	- 1.7
1970	15.8	-13.2	15.1	-17.5	69.1	8.8
1971	15.1	- 4.4	18.7	23.8	66.2	- 4.2
1972	16.8	11.3	18.9	1.1	64.3	- 2.9
Average 1967-1972	16.8	2.2	18.3	- 1.2	64.9	1.0
1973	20.2	-	13.7	-	66.1	-
1974	22.5	11.4	17.7	32.1	59.8	- 9.5
1975	25.8	14.7	9.7	-45.2	64.5	7.9
Average 1973-1975	22.8	13.1	13.8	- 6.7	63.4	- 1.0

Source: Appendix V. E.

* The Sector of mining and industry includes the sub-sectors mining, manufacturing, water supply, electricity and construction. The Sector of Services includes the sub-sectors; transport, wholesale and retail trade, ownership of dwellings, public administration and defence, banking, finance, and other sectors. The Sector of agriculture includes forestry, crops, and livestock.

TABLE V. 11.

Origins of the Resources and Their Use During 1967-1975.

(In Current Prices and Millions of Jordanian Dinars)

Period	Gross Domestic Product (G.D.P.)		Imports of Goods and Services		Exports of Goods and Services		Imports Minus Exports	Total Available Resources		Total Consumption			Gross Capital Formation (G.C.F.)				Stock Variation	Total of Use of Resources
	Value	Ratio to (T.A.R.)	Value	% of (T.A.R.)	Value	% of (T.A.R.)	Value	Value	% Change	Value	% Change	% of T.A.R.	Value	% Change	% of (T.A.R.)	% of (G.D.P.)	Value	Value
1967*	177.1	73.6	63.7	26.4	27.7	11.5	36.0	240.8	-	205.0	-	85.1	25.6	-	10.6	14.5	- 17.5	240.8
1968	168.5	64.9	91.0	35.1	28.3	10.9	62.7	259.5	7.8	212.0	3.4	81.7	30.6	46.5	11.8	18.2	- 11.4	259.5
1969	198.4	64.6	108.7	35.4	32.3	10.5	76.4	307.1	18.3	231.6	9.2	75.4	39.4	71.7	12.8	19.9	+ 3.8	307.1
1970	189.6	67.8	89.9	32.2	32.3	11.6	57.6	279.5	- 9.0	227.1	- 2.0	81.3	27.4	-37.0	9.8	14.5	- 7.3	279.5
1971	202.6	68.5	93.0	31.5	20.8	7.0	72.2	295.6	5.8	245.9	8.3	83.2	33.4	24.2	11.3	16.5	- 4.5	295.6
1972	224.2	65.2	119.9	34.8	51.8	15.1	68.1	344.1	16.4	266.1	8.2	77.3	39.4	2.8	11.5	17.6	- 13.2	344.1
Average 1967-1972	193.4	67.4	94.4	32.6	32.2	11.1		287.8	7.9	231.3	5.4	80.7	32.6	21.6	11.3	16.9		287.8
1973	239.3	63.7	136.4	36.3	50.29	13.4	86.11	375.7	-	303.4	-	80.1	51.3	-	13.7	21.4	- 29.3	275.7
1974	308.6	62.6	184.6	37.4	85.5	17.3	99.1	493.2	57.9	357.6	17.9	72.5	69.2	34.9	14.0	22.4	- 19.1	493.2
1975**	269.5	47.0	304.4	53.0	129.5	22.6	174.9	573.9	16.4	398.1	11.3	69.4	95.9	38.6	16.7	35.6	- 49.6	573.9
Average 1973-1975	272.5	57.8	208.4	42.2	88.4	17.7		480.9	37.2	353.0	14.6	74.0	72.1	36.8	14.8	26.5		480.9

* Figures for East Bank only.

** Preliminary.

Sources: (i) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletin, vol. 13, no. 11, November 1977, table (41) for the years 1973-1975.

(ii) Kingdom of Jordan, Department of General Statistics, National Accounts, 1967-1972, (Amman: Department of Statistics Press, n.d.), for the years 1967 to 1972.

resources were channelled to economic development than in the previous period. The share of exports of goods and services in the total resources averaged 11.1 percent annually and grew from JD 27.7 million to JD 51.8 million.

The total revenue of the Central Government averaged JD 75.61 million per year and grew from JD 70.42 million in 1967 to JD 78.96 million in 1972, an average annual rise of 5 percent.[1] Moreover, they constituted an average of 39.1 percent of GDP. Domestic revenue, however, represented only an average of 41.5 percent of total revenue and grew by an average of 9.1 percent, whereas foreign or external revenue constituted an average of 58.5 percent of the total and grew at an average of 2.5 percent annually. Foreign aid to Jordan during this period averaged JD 39 million per year and represented on average 51.6 percent of total revenue. Foreign aid, as budget support, represented on average 96.9 percent of total foreign aid, with the remaining 3.1 percent as technical and economic assistance.

On the expenditure side, total Government expenditure averaged JD 83.16 million per year and grew at an annual rate of 8.5 percent. Defence and security expenditure represented an average of 47.3 percent per year of total expenditure and an average of 52.3 percent annually of total revenue (see Table V. 12).[2] The deficit in the Government's budget increased during this period to reach JD 11.7 million by 1972, although it averaged only JD 7.6 million over the period as a whole.

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1. See,Table V. 12.

2. Table V. 13 indicates the percentage contribution of defence expenditure to the gross domestic product in some countries.

TABLE V. 12.

Total Revenue and Expenditure of Central Government, 1967-1975

(Values in Millions of Jordanian Dinars)

Period	Domestic Revenue			Foreign Revenue			Total Revenue (T.R.)		Total Foreign Aid (T.F.A.)		Budget Support			Technical and Economic Assistance			Total Expenditure (T.E.)		Defence and Security Expenditure				Deficit or Surplus
	Value	% Change	Ratio to T.R.	Value	% Change	% to T.R.	Value	% Change	Value	% Change	Value	% Change	% to T.F.A.	Value	% Change	% to T.F.A.	Value	% Change	Value	Ratio to T.R.	% to T.E.	% Change	Value
1967	25.50	-	36.2	44.92	-	63.8	70.42	-	40.4	-	38.0	-	94.1	2.4	-	5.9	68.15	-	28.56	41.0	42.0	-	2.27
1968	26.27	3.0	36.5	45.65	1.6	63.5	71.92	2.1	39.9	- 1.2	39.6	4.2	99.2	0.3	- 87.5	0.8	80.52	18.2	39.46	55.0	49.0	38.1	- 8.60
1969	32.52	23.8	42.6	43.86	- 3.9	57.4	76.38	6.2	38.4	- 3.8	37.6	- 5.1	97.1	0.8	166.7	2.9	88.41	9.8	46.17	60.4	52.2	17.0	- 12.03
1970	30.26	- 7.0	44.2	38.12	-13.1	55.8	68.38	-10.5	35.5	- 7.6	33.1	-12.0	93.2	2.4	200.0	6.8	80.71	- 8.7	38.21	56.0	47.3	- 17.2	- 12.33
1971	36.10	19.3	45.9	42.47	11.4	54.1	78.57	15.0	35.4	0	34.9	5.4	98.6	0.5	- 79.2	1.4	81.54	1.0	39.12	50.0	48.0	2.4	- 2.97
1972	38.50	6.6	43.8	49.46	16.5	56.2	87.96	12.0	44.5	25.7	44.0	26.1	98.9	0.5	0	1.1	99.63	22.2	45.07	51.2	45.0	15.2	- 11.67
Average 1967-1972	31.53	9.1	41.5	44.08	2.5	58.5	75.61	5.0	39.0	2.6	37.9	3.7	96.9	1.1	40.0	3.1	83.16	8.5	39.43	52.3	47.3	11.1	- 7.6
1973	46.18	-	44.7	57.05	-	55.3	103.23	-	43.7	-	43.5	-	99.5	0.2	-	0.5	119.51	-	48.397	46.9	40.5	-	- 6.28
1974	63.23	3.0	50.5	61.89	8.5	49.5	125.12	21.2	53.0	21.3	52.9	21.8	99.8	0.1	- 50.0	0.2	151.50	26.8	52.615	42.1	34.7	8.7	- 26.38
1975	84.21	33.2	43.6	109.00	93.3	56.4	193.21	54.4	90.0	69.8	86.5	63.2	96.1	3.5	340.0	3.9	209.43	38.2	63.972	33.1	30.6	21.6	- 16.22
Average 1973-1975	64.54	18.1	46.3	75.98	50.9	53.7	140.52	37.8	62.2	45.6	61.0	42.5	98.5	1.2	145.0	1.5	156.81	32.5	55.00	40.7	35.3	15.2	- 16.29

Source: (i) Kingdom of Jordan, Ministry of Finance, Annual Reports, (several issues), for the years 1967-1972.

(ii) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletin, (several issues), for the years 1972-1975.

TABLE V. 13.

Defence Expenditure as a Percentage of Gross National Product

State	1965	1966	1967	1968	1969	1970	1971
Egypt	8.6	11.1	12.7	12.5	13.0	19.6	21.7
Iran	4.4	3.6	5.5	5.6	6.0	7.1	8.5
Israel	11.7	12.2	13.8	15.4	24.1	26.5	23.9
Iraq	10.2	10.5	10.3	9.1	9.6	9.4	6.5
Jordan	12.9	12.2	12.8	14.7	21.0	16.4	11.3
Saudi Arabia	8.6	12.1	11.9	8.9	8.8	9.4	8.9
Syria	8.4	11.1	11.9	12.1	11.6	12.1	9.8

Source: International Institute for Strategic Studies, The Military Balance, (London: 1973), pp. 71-72.

C. ECONOMIC STRUCTURE AND GROWTH TRENDS DURING THE PERIOD 1973 TO 1975

Available data reveals that GDP for the East Bank of Jordan grew from JD 239.3 million in 1973 to JD 269.5 million in 1975, or a rise of an average of 8.2 percent annually.[1] Real GNP, however, grew at an average of 4.2 percent annually, whereas real per capita income declined at an annual average of 0.7 percent as a result of the increase in prices of 10 percent and in population of 3.5 percent. The price increase can be attributed to: the rise in agricultural costs; the rise in local and foreign demand; the higher rate of exports of local food products and the increased imports of processed food at much higher prices due to world-wide inflation; the rise in oil prices; and the reduction in the purchasing power of most world currencies including the Jordanian Dinar.

During this period, there was a substantial change in the relative importance of the economic sectors.[2] The value added in the industrial sector rose from JD 47.8 million to JD 68 million, or a rise of an average of 32 percent annually. The industrial sector contributed an average JD 61.7 million annually to GDP, or an average of 22.8 percent of GDP annually. Such contribution, however, grew at an average annual rate of 13.1 percent. This remarkable growth in value added can be attributed to the large increase in income from the phosphate rock industry, and the substantial growth in other industries, particularly the construction industry. The industrial production index increased from 139.1 in 1972 to 152.9 in 1973 and to 180 in June 1975 (1966=100). On the other hand, income from the agricultural sector declined from JD 31.9 million to JD 26.0 million in 1975. However, it grew at an average annual rate of 9.3 percent. The contribution of this sector to GDP averaged JD 37.5 million

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1. See,Table V. 8, and Appendix V. E.

2. See Tables V. 9, and V. 10, and Appendix V. E.

or an average of 13.8 percent per year and declined at an annual average rate of 6.7 percent. The services sector, however, contributed an average of JD 173.3 million to GDP, or an average of 63.4 percent annually of GDP. The value added of this sector, however, grew from JD 160 million to JD 175.5 million in 1975, or a rise of an average of 40 percent per year.

The analysis of total available resources over this period reveals that such resources averaged JD 480.9 million per year and rose from JD 375.7 million to JD 575.9 million, or an annual increase of 37.2 percent.[1] GDP, however, contributed an average of JD 272.5 million per year to total resources, or an average of 57.8 percent per year. The remaining 42.2 percent represented the contribution of imports of goods and services which averaged JD 208.4 million per annum. This situation clearly indicates that imports of goods and services rose significantly over this period when compared with previous periods. The decline in the share of GDP in the total available resources also indicates reduced capacity in the economy.

The analysis of the resource-use pattern, however, reveals that only an average of 74 percent of total resources was directed to consumption which averaged JD 353 million per year and grew at 14.6 percent annually. Furthermore, 26.5 percent per year on average was spent on investment in development projects. Gross capital formation during that period averaged JD 72.1 million per year and rose by an annual average of 14.8 percent. The share of exports of goods and services in total resources grew from JD 50.29 million in 1973 to JD 129.5 million in 1975. Thus, they constituted an average of 17.7 percent per year of total available resources.

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1. See, Table V. 11.

The Government's budget continued in deficit during this period. It averaged JD 16.29 million per year, growing from JD 6.28 million to JD 16.22 million in 1975. On the revenue side, however, total revenue grew from JD 103.3 million to JD 193.2 million, or a rise on average of 37.8 percent annually. Total revenue constituted an average of 51.6 percent per year of GDP. Of total revenue, an average of 46.3 percent per year represented domestic revenue and the remaining 53.7 percent represented external revenue. Domestic revenue averaged JD 64.54 million per year and grew at an annual average of 18.1 percent, whereas external revenue averaged JD 75.98 million and grew at an annual average of 50.9 percent.

Foreign aid to Jordan continued to account for a high ratio of total revenue (an average of 44.3 percent annually). Furthermore, it accounted for an average of 81.8 percent per year of external revenue. A great part of foreign aid, however, was provided as budget support (an average of 98.5 percent per year of total foreign aid). Only an average of 1.5 percent annually of total foreign aid was provided as technical and economic assistance.[1]

On the expenditure side, it is noted that total Government expenditure averaged JD 156.81 million per year and grew from JD 119.5 million in 1973 to JD 209.4 million in 1975, or a rise of a yearly average of 32.5 percent. Defence and security expenditure, accounted for an average of JD 55 million, or an annual average of 35.3 percent of total expenditure and 40.7 percent of total revenue (see,Table V. 12).

D. DEVELOPMENTS IN FOREIGN TRADE DURING THE PERIOD 1954 TO 1975

International trade, together with capital flows, has allowed many countries to overcome their supply bottlenecks through acquiring capital

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1. See,Table V. 12.

goods not available domestically. However, the extent to which a country participates in international trade depends on its resources, the barriers it places in the way of trade, and its stage of development.[1] Foreign trade plays a prominent role in initiating the earlier stages of economic development in the sense that imports create new tastes, stimulate new energies for work, and establish a new willingness to make the best use of available resources. Therefore, foreign trade, through the effects of increasing output for export purposes, alters the whole economic atmosphere of the economy. In primitive economies, the ratio of foreign trade to national income is usually low. This ratio, however, grows rapidly with economic development. Hence, the level of trade activities could signify industrialisation. Trade serves as a mechanism for the international division of labour, permitting specialisation in production in different countries and exchange of products among them. Thus, foreign trade is more important for developing countries than for developed ones since it offsets the limitations that would otherwise be imposed on their final consumption by the specialised nature of their domestic productive structure.

Foreign trade in Jordan grew from JD 21.64 million in 1954 to JD 77.7 million in 1966, to JD 112.2 million in 1972, and to JD 207.3 million in 1975.[2] Hence, it grew at an annual average of 9.8 percent during the period 1954 to 1966, 11.9 percent between 1967 and 1972, and 46.3 percent between 1973 and 1975. Over the whole period, 1954 to 1975, foreign trade grew by an annual average of 22.7 percent and averaged JD 12.1 million per year or 49.1 percent of GNP.

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1. William Arthur Lewis, Theory of Economic Growth,(London: George Allen and Unwin Limited, 1955), p. 340.

2. See,Tables V. 14., V. 15., and Appendix V. F.

TABLE V. 14.

Foreign Trade Activities in Jordan, 1954-1966

(Values in Millions of Jordanian Dinars)

Year	Imports				Exports and Re-Exports					Foreign Trade			Trade Deficit	Growth in Trade Deficit
	Value	Percentage Change	Ratio to F.T.	Ratio to G.D.P.	Value	Percentage Change	Ratio to G.D.P.	Ratio to F.T.	Ratio of Exports to Imports	Total F.T.	Percentage Change	Ratio to G.D.P.	Value	Value
1954	18.59	-	85.9	39.0	3.05	-	6.4	14.1	16.4	21.64	-	45.4	15.54	-
1955	25.26	35.9	87.7	59.6	3.54	16.1	8.2	12.3	14.0	28.80	7.16	67.8	21.72	39.8
1956	24.61	- 2.6	82.8	40.2	5.11	44.4	8.3	17.2	20.8	29.72	3.2	48.5	19.50	- 10.2
1957	29.76	20.1	84.5	48.1	5.48	7.2	8.9	15.5	18.4	35.24	18.6	57.0	24.28	24.5
1958	33.92	14.0	90.8	49.1	3.43	- 37.4	5.0	9.2	10.1	37.35	8.8	54.1	30.49	25.6
1959	39.26	15.7	92.1	46.1	3.35	- 2.3	3.9	7.9	8.5	42.61	14.1	50.0	35.91	17.8
1960	41.43	5.5	91.2	46.3	3.95	17.9	4.4	8.8	9.5	45.38	6.5	50.7	37.48	4.4
1961	40.93	- 1.2	88.6	36.9	5.27	33.4	4.8	11.4	12.9	46.20	1.8	41.7	35.66	- 4.9
1962	43.51	6.3	88.0	40.0	5.92	12.3	5.5	12.0	13.6	49.43	7.0	45.5	37.59	5.4
1963	53.63	23.3	89.1	45.5	6.56	10.8	5.6	10.9	12.2	60.19	21.8	51.1	47.07	25.2
1964	49.40	- 7.9	85.0	36.5	8.73	33.1	6.4	15.0	17.7	58.13	- 3.4	42.9	40.67	- 13.6
1965	55.80	13.0	85.0	37.0	9.91	13.5	6.6	15.0	17.8	65.71	13.3	43.6	45.89	12.8
1966	67.30	20.6	86.6	45.0	10.40	5.0	7.0	13.4	15.5	77.70	18.3	52. 0	56.90	24.0
Average 1954-1966	40.26	11.4	87.5	43.8	5.75	12.8	6.2	12.5	14.4	46.01	9.8	50.0	34.51	12.6

Source: (i) International Monetary Fund, Balance of Payments Yearbook, 1954-1959, (Washington, D.C.: I.M.F., n.d.), vols 8 and 12, for data covering 1954-1959.

(ii) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletin, vol. 5, no. 12, December 1969, for data covering 1960-1966.

TABLE V. 15.

Foreign Trade Activities in Jordan, 1967-1975

(Values in Millions of Jordanian Dinars)

Year	Imports				Exports and Re-Exports				Ratio of	Foreign Trade (F.T.)			Trade Deficit	Growth in Trade Deficit
	Value	Percentage Change	Ratio to F.T.	Ratio to G.D.P.	Value	Percentage Change	Ratio to G.D.P.	Ratio to F.T.	Exports to Imports	Value	Percentage Change	Ratio to G.D.P.	Value	Value
1967	54.20	-	82.7	30.6	11.3	-	6.4	17.3	20.9	65.53	-	37.0	42.87	-
1968	57.30	5.7	80.1	34.0	14.26	25.9	8.5	19.9	24.9	71.56	9.2	42.5	43.04	0.4
1969	67.75	18.2	82.1	34.2	14.75	3.4	7.4	17.9	21.8	82.50	15.3	41.6	53.00	23.1
1970	65.88	- 2.8	84.4	34.8	12.17	- 17.5	6.4	15.6	18.5	78.05	- 5.4	41.2	53.71	1.3
1971	76.63	16.3	87.0	37.8	11.44	- 6.0	5.7	13.0	14.9	88.07	12.8	43.5	65.19	21.4
1972	95.31	24.4	84.9	42.5	17.01	48.7	7.6	15.1	17.9	112.32	27.5	50.1	78.30	19.0
Average 1967-1972	69.51	12.4	83.5	35.7	13.49	10.9	7.0	16.5	19.8	83.0	11.9	42.7	56.02	13.0
1973	108.20	-	81.5	45.2	24.51	-	10.2	18.5	22.7	132.71	-	55.4	83.69	-
1974	156.51	44.7	75.9	50.7	49.76	103.0	16.1	24.1	31.8	206.27	55.4	66.8	106.75	27.6
1975	234.01	49.5	82.7	86.8	48.88	- 1.8	18.1	17.3	20.9	282.89	37.1	104.9	185.13	73.4
Average 1973-1975	166.24	47.1	80.0	60.9	41.05	50.6	14.8	20.0	25.1	207.29	46.3	75.7	125.19	50.5
Average 1954-1975	92.0	23.6	83.7	46.8	20.1	24.8	9.3	16.3	19.8	112.1	22.7	56.1	71.91	25.4

Source: Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletin, vol. 9 no. 8, August 1973 and vol. 13 no. 3, March 1977 (for data covering 1967-1975).

Imports, however, grew from JD 18.6 million in 1954 to JD 67.3 million in 1966, or a rise of an annual average of 11.4 percent. They constituted an annual average rate of 87.5 percent of total foreign aid and 43.8 percent of GDP and 36.2 percent of GNP during the period 1954 to 1966. However, between 1967 and 1972, imports rose by an annual average rate of 12.4 percent to reach JD 95.3 million in 1972. Furthermore, they constituted a lower proportion of foreign aid (83.5 percent) and of GDP and GNP (35.7 percent and 30.8 percent respectively). During the period 1973 to 1975, imports rose from JD 108.2 million to JD 234 million, or a rise of an annual average of 47.1 percent. They constituted an average of 80 percent of total foreign aid and 60.9 percent and 44.6 percent respectively of GDP and GNP. An analysis of the functional distribution of commodity imports, however, reveals that, by far, consumer goods constituted the biggest single item among imports. [1] Between 1954 and 1966, they constituted an annual average of 66.5 percent of total imports. However, during the period 1967 to 1972 their share in total imports dropped to an average of 54.5 percent per year. Between 1973 and 1975, consumer goods imports constituted an average of 70 percent of total imports. On the other hand, the share of capital goods in total imports averaged 10.7 percent annually, over the whole period 1954 to 1975. However, the share of intermediate goods and raw materials averaged 20.7 percent of total imports during the same period.

On the exports side, total exports and re-exports grew from JD 3.05 million in 1954 to JD 10.4 million in 1966, to JD 17.0 million in 1972 and to JD 48.9 million in 1975. Therefore, exports and re-exports grew

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1. See, Table V. 16, and Appendix V. F.

TABLE V. 16

Percentage Distribution of Imports and Exports by Economic Function

Imports	(1954-1966)	(1967-1972)	(1973-1975)	1954	1961
Consumer Goods	70	66.5	70.0		
Capital Goods	11	11.3	11.0		
Intermediate and Raw Materials	19	22.2	19.0		
	100	100.0	100.0		
Exports					
Phosphates			37	4	37
Manufactured Goods			16	2	12
Agricultural Products			25		
Re-Exports			22		
			100		

Source: (i) Kingdom of Jordan, The National Planning Council, The Five-Year Plan For Economic and Social Development 1976-1980, (Amman: 1976).

(ii) Appendix V. F.

by an annual average rate of 12.8 percent during the period 1954 to 1966, 10.9 percent between 1967 and 1972, and 50.6 percent over the period 1973 to 1975, or an increase of an annual rate of 24.8 percent between 1954 and 1975. Exports and re-exports averaged JD 20.1 million annually during this period and constituted an average annual rate of 16.3 percent of total foreign trade, 9.3 percent of GDP and 19.8 percent of total imports (see, Table V.15). The ratio of exports and re-exports rose from 16.4 percent in 1954 to 20.9 percent in both 1967 and 1975.[1]

The functional distribution of exports, however, indicates that phosphate rock exports constituted 4 percent of total exports in 1954, and 37 percent in 1961 and between 1973 and 1975. Manufactured goods, however, constituted 2 percent in 1954, 12 percent in 1961 and an annual average of 18 percent during the period 1973 to 1975.[2] Re-exports, on the other hand, constituted an average of 20 percent of total exports annually during the period 1973 to 1975, while agricultural exports accounted for an annual average of 25 percent of the total.

Finally, it should be remembered that over the whole period 1954 to 1975, a trade deficit existed. It averaged JD 71.91 million per year and grew at an annual average rate of 25.4 percent. Although the trade deficit continued to grow in absolute terms, it exhibited a relative decline between 1954 and 1972 in the sense that during the period 1954 to 1966 it constituted an average of 36.5 percent annually of GDP and during the period 1967 to 1972, representing an average of 30 percent of GDP annually.

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1. The per capita exports did not exceed JD 26 in 1974 while the per capita imports amounted to JD 83, from Kingdom of Jordan, The Central Bank of Jordan, Annual Reports, 1975 (Amman: National Press, 1976), p. 51.

2. Kingdom of Jordan, The National Planning Council, op. cit., p. 8.

However, the trade deficit constituted 45.9 percent annually of GDP between 1973 and 1975. The trade deficit is usually financed by: the surplus in both the invisible services account and the net factor income from abroad; capital and current transfers to the Government; transfers to the private sector; and by foreign aid.

The Balance of Payments account showed a surplus representing 6 percent of GDP throughout the period 1973 to 1975.[1]

PART FOUR: THE ROLE OF THE JORDANIAN GOVERNMENT IN ECONOMIC DEVELOPMENT

Initially, a developing country might start with poor overall economic planning which can be improved by improvements in microeconomic planning. Therefore, by successive attempts, a country might achieve more effective planning. The success of a plan, however, depends to a significant extent on a proper co-ordination of its objectives, instruments, and technical and economic factors. The administrative aspects of implementing a plan are important. Studies have indicated that weakness in the administrative machinery responsible for carrying out a plan is one of the most frequent causes of breakdown in the execution of a plan. Hence, feasibility studies on development projects should include administrative aspects as well as economic and technical ones.[2] It has been noted that most developing countries, including Jordan, tend to have an under-developed administration.[3] Therefore, it is essential for such countries, when preparing their social and economic plans for development, to have an efficient administrative structure to enable them to carry out these

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1. Kingdom of Jordan, The National Planning Council, op. cit., p. 39.

2. United Nations, Administrative Aspects of Planning, (New York: U.N. Publications, 1969), p. 20.

3. A. H. Hanson, The Process of Planning: A Study of India's Five-Year Plan, (London: Oxford University Press, 1966), p. 268.

plans. To achieve this, in 1957, the Jordanian Government established the Jordan Development Board with responsibility for designing, formulating and following up development programmes.

Development planning in Jordan started in 1962, when the Five-Year Plan for Economic and Social Development was first introduced.[1] It was later revised and replaced by the Seven-Year Development Programme (1964-1970) because of unexpected reductions in the level of budget support. The main objectives of the Seven-Year Development Programme were:[2] to reduce the trade deficit and the dependence on budget support; to increase the Gross National Product by a yearly average of 7.3 percent; and to increase employment opportunities at an average rate of 5.2 percent per annum. Thus, the Plan aimed at moving the country as rapidly as possible along the path of economic independence, and self-sustained growth.

In the period preceding the 1967 June War, most of the Plan's objectives had been achieved. Gross National Product grew at an annual average of 11.5 percent within the framework of relative price stability and a population growth of 3.1 percent annually. This rapid economic growth meant a real and tangible improvement in living standards. However, the June War of 1967 and its consequences interrupted the rapid economic growth and major development projects had to be suspended.

In 1971, the National Planning Council replaced the Jordan Development Board and in the beginning of 1972 it launched a three year development plan to cover the period 1973 to 1975. The main objectives of the new Plan were:[3] to create 70,000 new job opportunities; to achieve

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1. For details about the process of planning see, Appendix V. G.

2. Kingdom of Jordan, Jordan Development Board, The Seven-Year Programme For Economic Development of Jordan, (Amman: The Commercial Press, 1971), pp. 5-6.

3. Kingdom of Jordan, Central Bank of Jordan, Annual Report, 1972, (Amman: the National Press, 1973), pp. 54-70.

an average annual growth rate of 8 percent in Gross National Product; to maintain price stability; to distribute economic gains more equitably between people and regions; to increase the extent to which the State budget relied on domestic revenues over the period by 39 percent; and to improve the Balance of Payments and reduce the trade deficit. The Plan also called for total investment of JD 179 million. The goals of this Plan were not fully achieved. Only JD 172 million was invested during the currency of the Plan and the Gross National Product grew by an annual average of 5 percent.[1] Nevertheless, it could be argued that the Plan succeeded in revitalizing economic activity and strengthening the necessary bases for economic development.

The National Planning Council also formulated the Five-Year Plan for Economic and Social Development, 1976 to 1980, to sustain the development momentum in the country. The main objectives of the Five-Year Plan are:[2] to realise an average annual growth of 12 percent in GNP (at 1975 prices); to develop economic and social activities in various regions of the country by a fair distribution of the economic gains; to increase the reliance of the Government's budget on domestic financial resources; and to reduce the chronic trade deficit from 41.6 percent of GNP in 1975 to 20.7 percent by 1980. Furthermore, the Plan calls for an investment of JD 765 million during the currency of the Plan, of which JD 382 million was to be invested by the public sector and JD 383 million by the private sector.[3]

In addition to long term economic and social planning, the Jordanian Government has taken certain measures to encourage industrialisation in the country, which has been hampered by the low purchasing power of the

1. Kingdom of Jordan, The National Planning Council, op. cit., pp.26-29.
2. Ibid., pp. 65-70.
3. Ibid., pp. 80-85.

domestic market; the high cost of power; the lack of adequate internal financing; the shortage of technically skilled labour; the inadequate managerial personnel; and the absence of any significant industrial raw materials other than olive oil, tobacco, potash and phosphates. These measures include:[1] the provision of credit facilities; temporary exemption from income taxes and import duties for new industries; and the encouragement of foreign private investment by giving foreigners the right to invest and withdraw funds with minimal restrictions. Furthermore, the Jordanian Government acquired shares in private and public establishments in order to promote and regulate them, and encourage other investors to invest in such establishments.

PART FIVE: SUMMARY AND CONCLUSION

(i) A characteristic of Jordan, as well as other countries in the Middle East, has been the existence of conflict within and between states. The boundaries of Jordan were delineated on the basis of political rather than economic considerations. Conflict in the area has caused the boundaries of Jordan to be changed twice; once after the 1948 War and then again after the 1967 June War. Furthermore, the existence of the conflict undoubtedly disrupted the economic growth of the country since it affected the availability of resources and use of manpower.

(ii) The Jordanian population is characterised by relatively high growth rates because of the influx of refugees from Palestine after the 1948 War and from the West Bank after the 1967 June War. This influx

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1. For details on such measures see, Kingdom of Jordan, Ministry of Trade and Industry, The Encouragement and Guidance of Industry Law No. 27 of 1955, and Kingdom of Jordan, Ministry of National Economy, The Jordan Investment Promotion Office, The Encouragement of Investment Law No. 1 of 1967, and The Encouragement of Investment Law No. 53 of 1972.

added a heavy burden to an already over-strained economy, since it was not matched by sufficient growth in the already meagre natural and capital resources of the country.

(iii) The labour force in Jordan constituted about 19.6 percent of the total population. The distribution of the labour force among the economic sectors, however, experienced considerable change between 1961 and 1975, particularly in the agricultural and services sectors. As a result of the rapidly increasing demand for trained manpower in the Middle East region, Jordan suffered a drain on its trained personnel which in turn affected its ability to implement and mange its economic and social development programmes.

(iv) The Jordanian economy has experienced real growth. This growth has not been maintained mainly due to the interruptions of economic activities by wars and civil disturbances. In real terms, the GNP during the whole period from 1954 to 1975 grew at an annual average rate of 4.8 percent. The Per Capita National Income, however, grew at an annual average of 1.5 percent.

(v) There have been significant changes in the relative importance of the different economic sectors in the GDP.[1] The relative slow growth of the agricultural sector and the decline in its contribution to the GDP is attributed to the primitive production methods, lack of finance, low productivity of labour, weather conditions, and the 1967 War and its consequences. Therefore, the Jordan Government should pay more attention to this sector whose production could be improved by increasing the use of cultivated land, providing the sector with financial credit at low interest rates, and implementing more irrigation projects. The industrial sector, on the other hand, was relatively successful in performance, and this can be attributed to the expansion in production of the phosphate

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1. Appendix V. H. summarises the relative importance of the economic sectors in GDP and their growth between 1954 and 1975.

rock industry and other existing industries, and the establishment of new industries. Industrialisation in Jordan has been similar to that in other developing countries since most of its industries are import substituting industries. The services sector, meanwhile, continued to be the main contributor to the GDP.

(vi) The resource-use pattern, however, indicates that a greater part of total resources was used for consumption purposes. In fact, the consumption level for many years was higher than that of the GDP. Nevertheless, there has beena considerable shift from consumption to investment in development projects

(vii) More than half of total revenue to Central Government represented external revenue. The greater part of external revenue represented foreign aid to Jordan, mainly as budget support. Such aid has played a prominent role in financing the deficit in the Balance of Payments. On the expenditure side, about 45 percent of the total was spent on defence and public security. The Middle East conflict caused all states in the Middle East to maintain large defence forces. Throughout the 1960's and 1970's they generally allocated increasing and sizable proportions of their GNP to military purposes (though a decline was apparent in some cases).

(viii) A useful index of the viability of a state is its balance of trade. Unfortunately, this has weighed heavily against Jordan with imports far exceeding the value of exports, giving a chronic deficit in her trade balance. The major factors contributing to this situation have been serious challenges and sacrifices imposed by the 1948 and 1967 wars, and the internal strife of 1970. This deficit has been financed by: the surplus in both the invisible services account and the net factor income from abroad; capital and current transfers to the Government and to

the private sector; and by foreign aid.

(ix) The Jordanian economy is based on free enterprise and the Government's role in the private productive sectors has been basically promotional and regulatory. The Government has launched four plans for social and economic development, which have succeeded in stimulating economic activities and strengthening the necessary bases for economic and social development. The Government has also taken different measures to encourage industrialisation in the country, but development efforts have often been interrupted by the Middle Eastern conflict and its consequences.

(x) Finally, the future of Jordan would seem to be in the balance, unless a 'just and lasting' peace is achieved in the Middle East. Then, there might be some hope that the Jordanian economy could be restored to the potentially favourable condition which existed prior to the 1967 June War. Nevertheless, there would be a long period before full economic viability is reached. With the rationalisation of farming, the development of commercial agriculture, the proper exploitation of phosphate rock and potash mineral reserves, and the expected growth in tourism, most of the economic portents for the future would appear to be propitious.

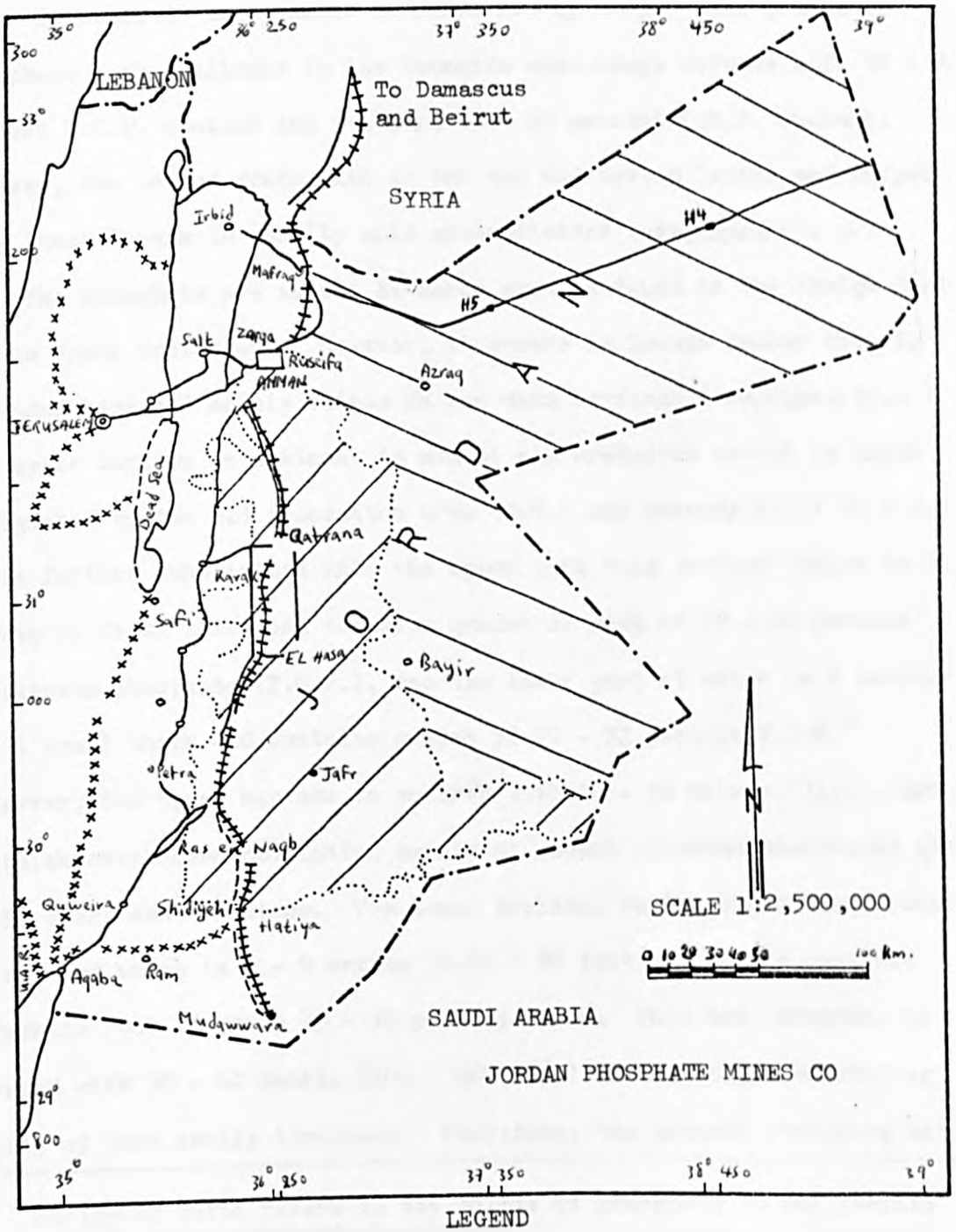
CHAPTER SIX: JORDANIAN PHOSPHATES AND THE IMPACT OF THE PHOSPHATE ROCK INDUSTRY ON THE JORDANIAN ECONOMY

PART ONE: GEOLOGY OF THE JORDANIAN PHOSPHATE ORE

Phosphate formations in Jordan occur near the surface in the Meastrichtian level throughout the area covered with Upper Cretaceous formations. These formations, therefore, are older than those in northern Africa which are of early Eocene origin. The Upper Cretaceous formations extend over a wide area of approximately 20,000 km^2. from some 20 km. north of Amman with a width of 15km. to Maán in the south with a width of up to 160 km. To the east of this belt, however, the Eocene occurs on top of the phsophate formations over an area of 32,000 km^2, thus bringing the total potential phosphate area to around 60 percent of the whole area of Jordan (see, Figure VI. a). Nearly all phosphate deposits known in Jordan occur above the water-table. Thus, no hydrological problems are expected to arise, although the deposits are slightly affected by folding and faulting tectonics. Phosphate ore is mined only at Russeifa and El-Hassa. However, plans exist to operate other mines, such as at Shydieh for the 1980's. Principally, three types of phosphate deposits exist in Jordan: the phosphorite which has a white to pinkish or yellowish colour and is composed of chalky nodules, less than 1 m.m. in diameter, mixed with fossil fragments; the hard rock deposits which resemble hard limestone in appearance; and the green phosphate or flourapatite which resembles greenish crystalline limestone.

In the Russeifa area, the phosphate ore occurs in the 'Belga Series' of the Upper Cretaceous with a thickness of about 12 metres (about 40 feet) and in four exploitable phosphate layers each of which is 1.5 - 3.0 metres (5 to 10 feet) thick. These layers, however, are interbedded with barren horizons consisting of marl, limestone and chert. They are usually

FIGURE VI.a. PHOSPHATE POTENTIAL AREAS IN JORDAN



LEGEND

- ⊙ City
- o Town
- • Village
- —— Asphalt road
- —·— Country's Boundary
- ····· Geological Boundary
- +++++ Railway
- ▨ Shallow Phosphate
- ▨ Deep Phosphate

covered with 15 - 20 metres (50 - 67 feet) of thick overburden consisting mainly of recent coarse alluvium associated with marl, thin chert and limestone. Thus, the present stripping ratio ranges between 1:2.5 and 1:3. However, it is expected to reach 1:4 by 1979.[1] The grades of phosphate rock available in the Russeifa area range between soft 62 - 72 percent T.C.P. content and the hard 45 - 60 percent T.C.P. content. However, the better grades lie in the top and bottom layers and output from these layers is usually sold unbeneficated (see,Figure VI. b)

The phosphate ore in the El-Hassa area is found in the 'Belga Series' of the Upper Cretaceous. However, it occurs in lenses rather than in extended beds and mainly exists in two main horizons (see,Figure VI.c) The upper horizon is dominant in almost all orebodies except in those designated by the old concession area (O.C.) and orebody No. 1 (O.B.I.). It is further sub-divided into the upper part 'the protore' which is 0.6 metres (2 feet) thick and contains grades of rock of 60 - 62 percent tricalcium phosphate (T.C.P.), and the lower part of which is 2 metres (6.66 feet) thick and contains grades of 70 - 72 percent T.C.P.[2] Moreover, the upper horizon is covered with 10 - 30 metres (33.3 - 100 feet) of thick overburden consisting mainly of recent alluvium associated with marl, chert and limestone. The lower horizon, on the other hand, consists of one bed which is 2 - 9 metres (6.66 - 30 feet) thick and contains phosphate rock of grade 73 - 76 percent T.C.P. This bed, however, is covered with 30 - 60 metres (100 - 200 feet) of overburden consisting mainly of hard shelly limestone. Therefore, the present stripping ratio

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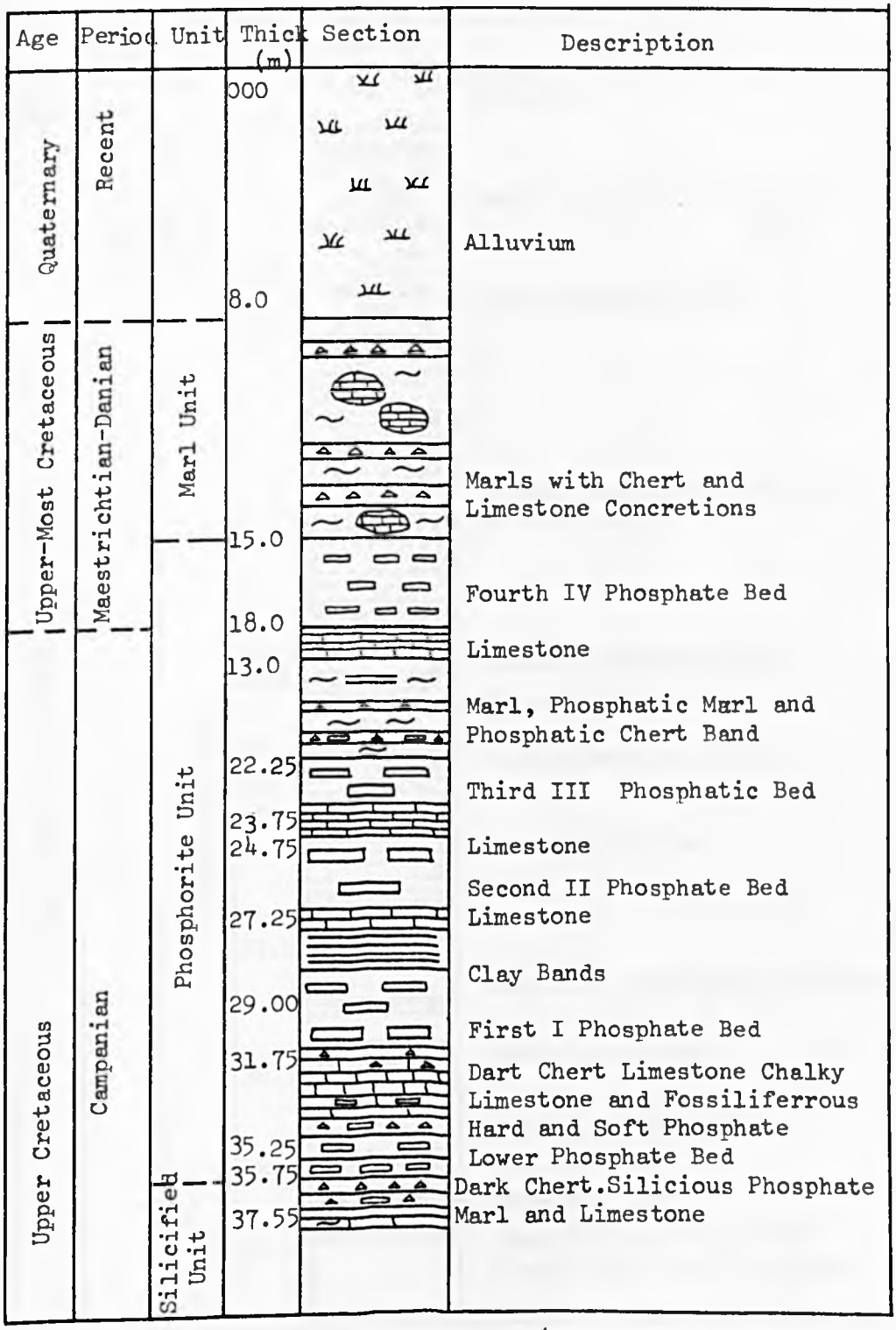
1. Stripping ratio refers to the volume of phosphate to the sterile materials in a geological section.

2. Protore refers to the phosphate ore found in the upper part of the upper horizon which contains grades of rock with 60 - 62 percent T.C.P.

FIGURE VLb. - GEOLOGICAL SECTION AT RUSEIFA MINE.

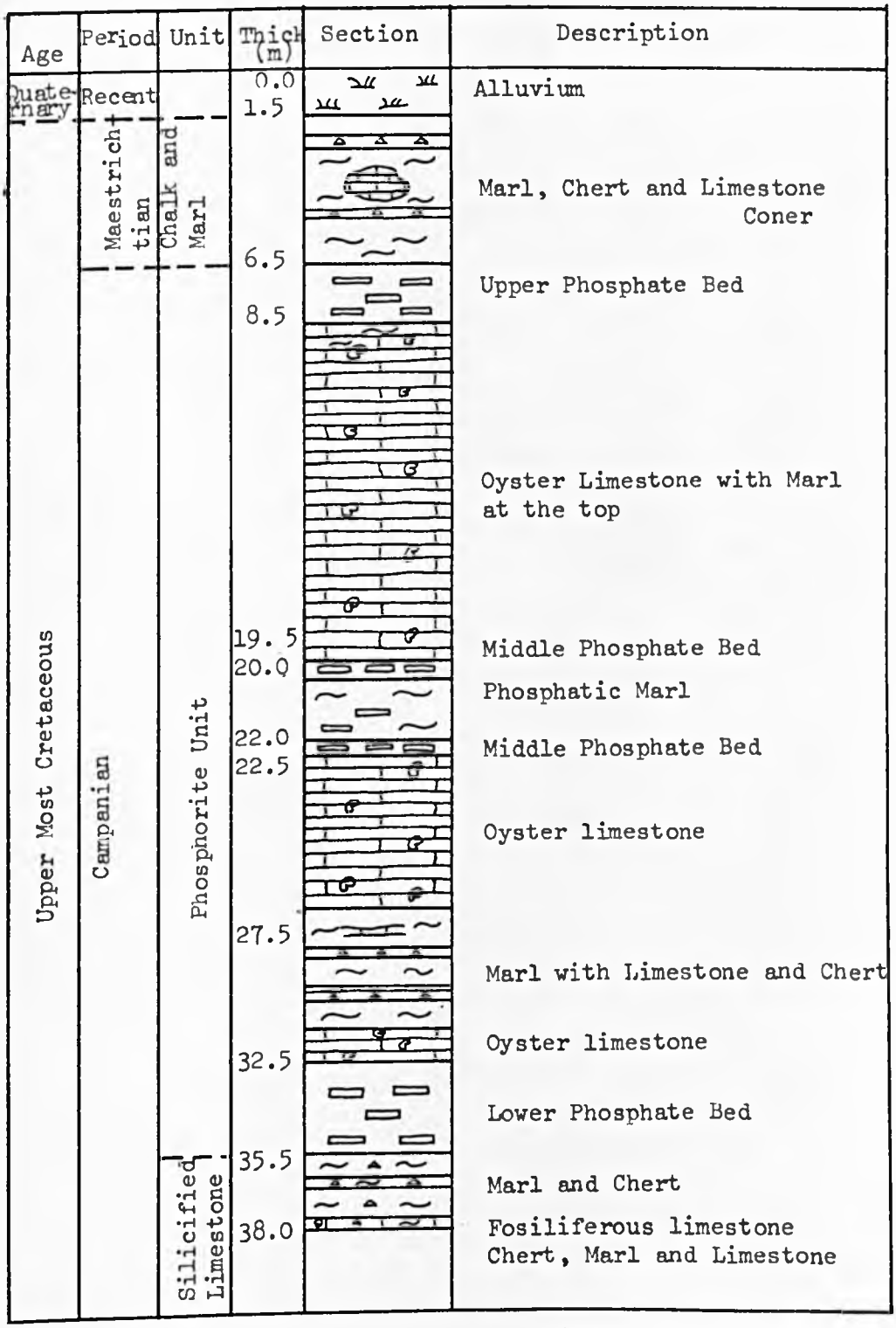


(After JPMC - 1975)

Legend

Alluvium
Limestone
Chert
Marl
Phosphate
Clay

FIGURE VI.c. - GEOLOGICAL SECTION AT EL-HASSA MINE



(After JPMC - 1975)

Legend

Alluvium
Limestone
Chert
Coquinoid Lst.(Oyster)
Phosphate
Marl

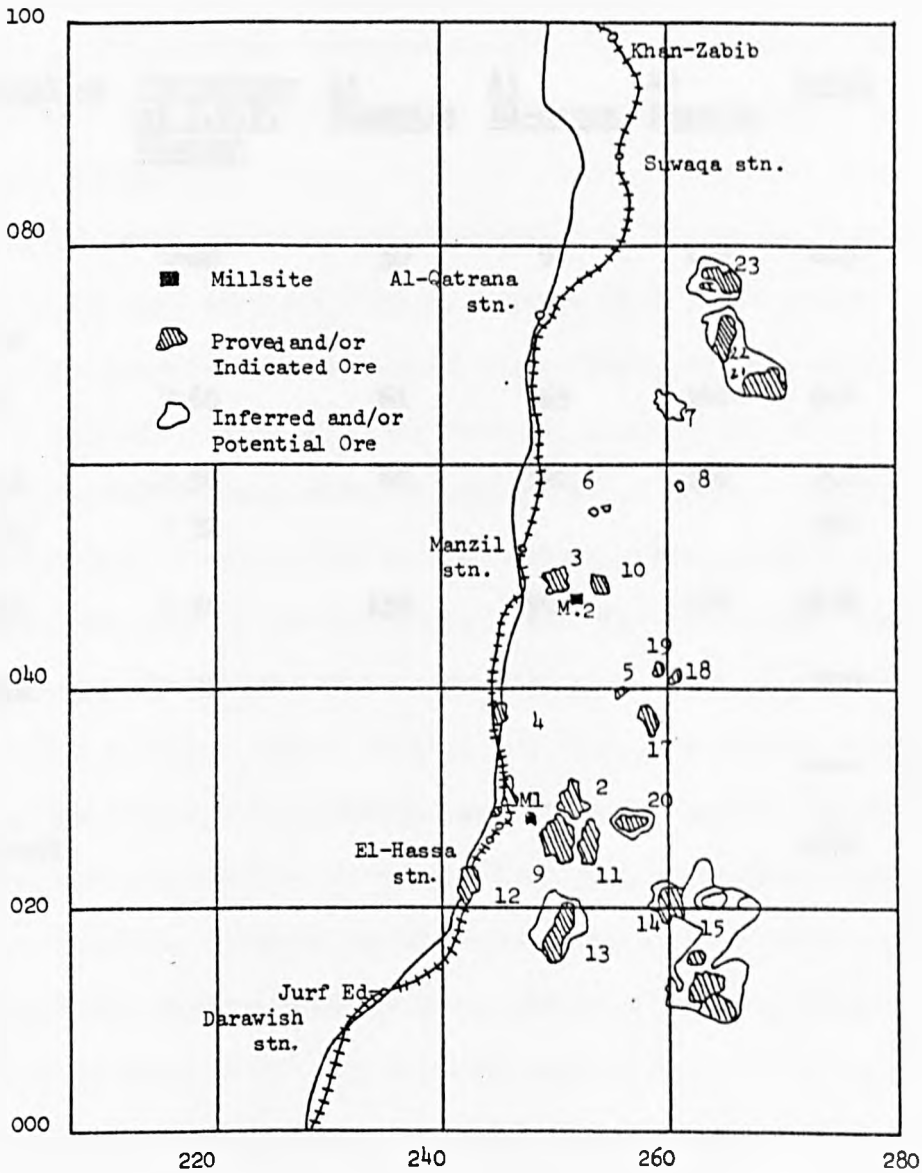
at El-Hassa ranges between 1:4.5 and 1:5 and will possibly reach 1:10 by 1980. So far, some 25 phosphate orebodies have been delineated in the El-Hassa area - south of Qatrana and east of the highway (see, Figure VI. d)

PART TWO: ASSESSMENT OF ORE RESERVES

In Jordan known phosphate rock reserves are usually classified into three categories: proven reserves; indicated reserves; and inferred or possible reserves. 'Proven reserves' are estimated on the basis of exploratory drilling at close distances not exceeding 200 metres (666 feet); 'Indicated reserves' are estimated on the basis of drilling at distances not exceeding 400 to 500 metres (1,332 to 1,665 feet); and 'Possible reserves' are assessed on the basis of drilling at distances of 1 km. (3,330 feet). Proven reserves must be of sufficient quality and quantity to warrant commercial exploitation. The other types of reserves, however, must undergo substantial additional drilling and exploration before being exploited.

The level of reserves in Jordan tends to vary depending on the source of reference. However, according to the JPMC, the stock of phosphate rock in Jordan is estimated at about 2 billion tons or about 4 percent of world reserves of phosphate rock (see, Table VI. 1). These estimates, however, are liable to increase with developments in explorations and research. Analysis of the figures in Appendices VI. A., VI. B., and VI. C. reveals that the reserves of the southern orebodies around Millsite No. 1 in the Russeifa area will be exhausted by 1980 and the proven reserves of the northern area of orebodies 'Zerka B and Zerka A' around Millsite No. 2 at Russeifa estimated at 30 million tons could support an annual rate of production of 1 to 1.5 million tons of dry product for 8 to 10 years, once production starts from that Millstone in 1980. On the other hand, Appendix VI. A. reveals that the 81 million tons of proven reserves around

FIGURE VI .d. - OREBODY LOCATION AT EL-HASSA



SCALE

1 : 1,500,000

(After JPMC - 1975)

TABLE VI. 1.

Summary of Jordanian Inventory of Phosphate Reserves as of 13.12.75

(in million metric tons)

Classification	Percentage of T.C.P. Content	At Russeifa	At El-Hassa	At Shydieh	Total
Proven	>60	38	97	130	265
Indicated and Inferred	>60	61	463	140	664
Potential	> 50	60	347	300	707
Potential	> 32				500
Sub-Total	> 50	159	907	570	1636
Sub-Total	> 32				500
Grand Total					2136

Source: Kingdom of Jordan, Jordan Phosphate Mines Company, (Amman: 1976).

Millsites No. 1 and No. 2 in the El-Hassa area could support an annual rate of production of 5 million tons of dry product for approximately 10 years.[1] Furthermore, Appendix VI. C indicates that the 130 million tons of proven reserves at Shydieh could support for about 20 years, starting in 1980, an annual rate of production of 5 to 6 million tons of dry product. In addition, the potential reserves in all areas, when proved, should further extend these productive lives (see, Appendix VI. D).

PART THREE: TECHNOLOGY

Phosphate rock in Jordan is extracted from the Russeifa and El-Hassa mines by mechanized open-pit mining, because of the favourable overburden to ore ratio encountered over a wide area. There is also underground mining at Russeifa mines, but this is being phased out. The process of mining by the underground method consists of two stages: the first, called the 'development' stage begins by drilling main transportation and ventilation channels in the phosphate beds. This operation results in forms of phosphate columns with areas ranging between 40 and 48 square metres (133.2 to 159.8 square feet). The actual extraction of phosphate occurs in the second stage, namely the 'stopping' stage. At this point, iron or wooden pillars are placed parallel to the phosphate columns formed in the first stage at about 80 centimetres (2.7 feet) apart, and they support the upper phosphate beds. Holes are then drilled by hand or by air driven jack hammers for the insertion of explosives which break down the columns of phosphate. Open-pit mining involves the removal by bulldozers of the overburden, a layer of rocky and other non-phosphatic sub-soil which covers the phosphate ore. Phosphatic beds are then ready

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1. 81 million tons are equivalent to about 50 million tons of dry product, assuming an overall average recovery of 60 percent.

for extraction. Open-pit operations are used if phosphate beds are on the surface. The ratio of phosphate rock extracted to the overburden and sterile material excavated determines the proximity of phosphate beds to the surface.

The aim of mining, whether using the open-pit or underground method, is to reach the phosphatic beds and collect and transfer the rocks to the processing areas at the mines. The phosphate rock at this stage frequently contains up to 12 percent moisture and consists of different sizes. These rocks must be beneficated in a different manner depending on the grade of rock demanded, although some rocks are marketed at this stage.[1] The remainder is either stored for future use or directed to the processing stage in order to raise the T.C.P. content and reduce that of iron, aluminium oxides and moisture. Figure VI. e shows a flow-sheet representing the steps followed in processing and manufacturing the phosphate rock. The process applied at the Russeifa and El-Hassa mines are somewhat different due to the minerological composition of the extracted ore (see, Appendix VI. E).

The manufacturing process applied at Russeifa mines is simple. The extracted ore is delivered by trucks to the primary crushing plant, after which the screened product (less than $\frac{3}{4}$") goes for further processing, whereas the larger product (greater than $\frac{3}{4}$") is rejected.[2] At this stage, the screened product of high grade feed contains 70 - 72 percent T.C.P.

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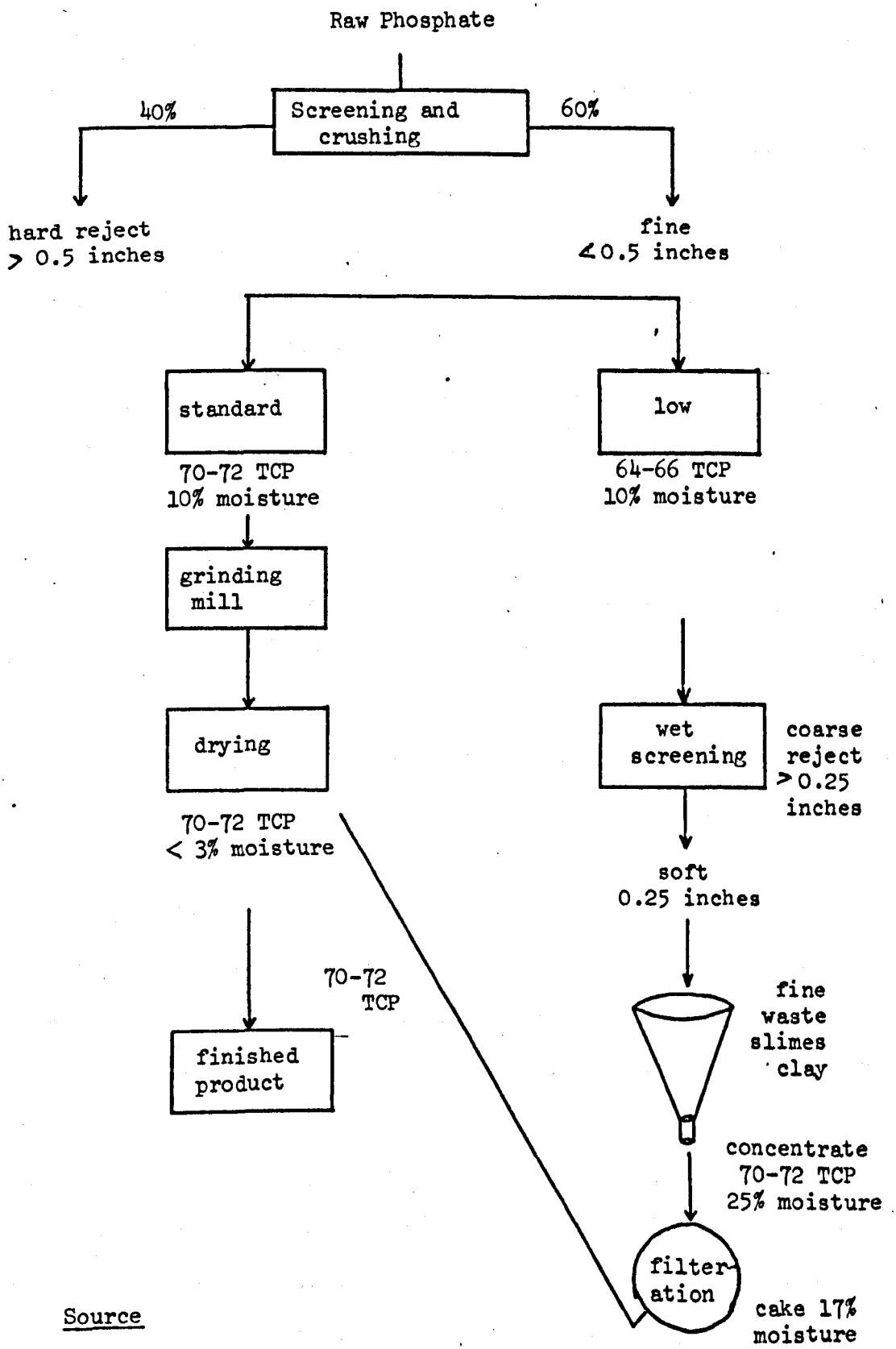
1. Benefication is a process involving washing, classifying, floatation and thickening to raise the phosphate content and reduce that of iron and aluminium oxides.

2. These measurements are standards in the world phosphate rock industry. The smaller the measurement, the higher the T.C.P. content is.

FIGURE VI.e. - PROCESSING AND MANUFACTURING OPERATIONS OF PHOSPHATE ROCK.



Source

Kingdom of Jordan, JPMC, the Geology Department.

and 8 to 12 percent moisture. The moisture is then reduced by rotary dryers to below 2 percent. The dried product is marketed as Russeifa S-grade product with 70 - 72 percent of T.C.P. content. On the other hand, the screened product of low grade feed containing 62 - 64 percent T.C.P. only becomes marketable after being beneficated through a wet process consisting of wet screening ($\frac{1}{4}$") followed by deliming in a two-stage hydro-cycloning plant. The under-flow of the second hydro-cyclones is washed and filtered on continuous belt filters. At this stage, the product contains 68 - 72 percent T.C.P. and 16 to 18 percent moisture. This product is then dried in rotary dryers to reduce the moisture content to well below 2 percent and marketed as Russeifa C-grade product with 70 - 72 percent T.C.P. content. However, in practice, the C-grade and the S-grade products are mixed together because of their similar chemical composition and they are marketed as Russeifa 70 - 72 percent T.C.P. content grade product. The average weight recovery of the marketable phosphate rock at Russeifa ranges between 32 and 51 percent, where approximately 3 million cubic metres per year are excavated. The average annual production capacity stands at 750,000 tons and drying capacity at 900,000 tons. However, the C-grade beneficated product constitutes an average of only 300,000 tons annually.

At the El-Hassa mines, on the other hand, the extracted ore consists of a mixture of ore and protore with an average T.C.P. content of 66 percent. The raw ore is delivered by trucks to the crushing and screening plants where the size of rock is reduced to less than $\frac{1}{2}$". The screened product is sent for treatment by a long conveyor belt to the Millsite, whereas the unscreened product is delivered by large dump trucks to large open storage areas in the vicinity of the mines for future treatment. The screened product is afterwards sent to a washer by a mechanised handling

system consisting of feeder, weighing machines, conveyor belts and hoppers. This step is followed by wet screening to eliminate the coarse fractions (larger than 0.2"). The resulting pulp is pumped to the wet benefication plant, consisting of a three-stage agitation/hydro-cycloning circuit, followed by centrifuge filters used for dechlorination. The filter cake with 17 to 18 percent moisture is delivered by a swing belt system to a storage area or directly to the fuel oil-fired rotary dryers, where the product is dried, resulting in a product with 73 - 75 percent T.C.P. content and 1.0 to 1.5 percent moisture. The product is then stored in two equal concrete bins of 5,000 tons capacity. At the El-Hassa mines, the present annual production capacity (Millsite No. 1) consists of 750,000 tons of the S-grade product and 500,000 tons of the C-grade product, or a total of 1.25 million tons. The annual capacity of the benefication plant, which was first built in 1967, is 500,000 tons. Again, excavation at El-Hassa is undertaken by private contractors and the Mining Department of the Jordan Phosphate Mines Company (JPMC).

PART FOUR: PRODUCTION OF PHOSPHATE ROCK IN JORDAN

A. ESTIMATION AND ANALYSIS OF A PRODUCTION FUNCTION FOR THE JORDANIAN PHOSPHATE ROCK INDUSTRY

This section utilizes production theory concepts together with a multiple regression to derive a production function for the phosphate rock industry in Jordan.[1]

The general production function states the explicit relationship between outputs and inputs. Hence, the generalized production function for a firm can be given by:

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1. For detailed analysis on production theory, see, Milton H. Spencer, Marginal Economics, (Chicago: Richard D. Irwin Inc., 1968), Thomas H. Naylor and John H. Vernon, Micreconomics and Decision Models of the Firm, (New York: Harcourt and Brace World Inc., 1969), Z. Griliches and V. Ringstad, Economics of Scale and the Form of Production Function (Amsterdam: North Holland Publishing Company, 1971), and C.E. Ferguson and S. C. Maurice, Economic Analysis (Chicago: Richard D. Irwin Inc., 1970).

$$Q\ (Y_1, \ldots Y_p, X_1, \ldots..xm) = 0$$

where $Y_k \geq 0$ are products ($k = 1, 2, \ldots, p$)

and $x_i \geq 0$ are inputs ($i = 1, 2, \ldots., m$)

The application of this general form to the phosphate rock industry in Jordan results in a production function that expresses the relationship between the maximum quantity of output and the inputs required to produce such a maximum, and the relationship between the two inputs themselves.[1] This implies that the technical maximization problem has been solved since the maximum output is obtained for each combination of inputs. Symbolically, this function can be written as:

$$Y = F(K, L)$$

where (Y) is the gross output, (K) and (L) are the services of capital and labour inputs respectively, and (F) represents the functional relationship between the output and inputs.

The optimum solution for input combination requires, however, that the ratio of their marginal product (MP) be equal to the ratio of their prices. This situation, therefore, can be shown as:

$$\frac{MP_L}{MP_K} = \frac{P_L}{PK} \quad \text{or} \quad \frac{MP_L}{PL} = \frac{MP_K}{PK}$$

The ratio of marginal product to the price of an input measures what the firm gets by putting an additional Jordan Dinar into that input.

For the economist, the production function can be represented graphically by a set of curves, iso-quants, each representing various combinations of inputs which produce a given output and are convex downwards expressing the law of diminishing marginal rate of substitution between the two inputs.[2] For any given technology, however, no two iso-quants can

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1. George M. Katz, Production Functions, Foreign Investment and Growth, (Amsterdam: North-Holland Publishing Company, 1969), pp. 27-35.

2. R. Frisch, Theory of Production, (Amsterdam: D. Reidel Publishing Company, 1965), p. 50.

intersect. Moreover, the neoclassical criteria or conditions are assumed to hold concerning this production function.[1] Therefore, defined as such, the production function has four characteristics which are called, when taken together, 'an abstract technology'. These characteristics include: the efficiency of technology; the degree of economies of scale that is technologically determined; the capital intensity of a technology; and the ease with which capital input is substituted for labour input.[2] The first of these characteristics only affects the relation between output and inputs, where the greater the efficiency of a technology the greater the output.

As far as the second characteristic is concerned, the concept is defined as follows:[3]

> 'For a given proportional increase in all inputs, if output is increased by a larger proportion, the firm enjoys increasing returns (or economies of scale); if output is increased by the same proportion, there are constant returns to scale; and if output is increased by a smaller proportion, decreasing returns result (or diseconomies of scale).'

Technological progress can alter the way in which inputs are transmitted into output in such a manner that the production process formerly characterised by decreasing returns is now characterised by constant returns, while the scale of operations of the firm remains constant. Technological progress can be embodied or disembodied. Embodied technological progress is defined as favourable shifts in the production function which leave the efficiency of already established production units unaffected, whereas the disembodied technological progress is defined as favourable shifts in the production function, even in the absence of investment.[4] Embodied technological progress affects the production

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1. For details, see, Murray Brown, On the Theory and Measurement of Technological Change, (London: Cambridge University Press, 1966), pp.31-35.
2. Ibid., p. 12.
3. Ibid., p. 13.
4. L. Johansen, Production Functions, (Amsterdam: North-Holland Publishing Company, 1972), pp. 144-152.

function only by influencing the distribution of the new capacity, while disembodied technological progress affects the modes of operation of existing production units in such a manner as to improve their performance.

The capital intensity of a technology is defined as the quantity of capital relative to the quantity of labour used in the production process.[1] The larger the capital-labour ratio, the more capital intensive the firm is. The capital intensity of a technology, however, affects the marginal rate of substitution as well as output.

The fourth characteristic, namely the ease with which capital is substituted for labour, can be measured by the elasticity of substitution which indicates how rapidly diminishing returns set into one factor of production when its prices fall relative to another factor price. The elasticity of substitution can take any value between zero and infinity. Moreover, the marginal product of capital rises relative to that of labour as the ratio of employment of labour rises relative to the rate of capital. However, the rate at which the marginal product of capital rises depends on the elasticity of substitution.

A. 1. Cobb-Douglas Production Function and its Application to the Phosphate Rock Industry in Jordan

The Cobb-Douglas Production Function designed by Paul H. Douglas and C. W. Cobb has served as an analytical basis for a great deal of later production research by other econometricians. It can be represented in

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1. Murray Brown, op. cit., pp. 15-17.

the following form:[1]

$$Y = A_t L^c K^{1-c}$$

where (Y) represents output level at constant prices,

(A_t) represents the index of total factor productivity,

(L) and (K) stand for labour and capital inputs expressed in physical units and in value terms at constant prices respectively,

(c) and (1 - c) represent the elasticities of output with respect to labour and capital inputs.

This function was originally assumed to exhibit constant returns to scale. However, at a later stage, it was adjusted so that the exponents might add up to less or more than unity. Hence, the function could exhibit decreasing, constant or increasing returns to scale in its new form which can be written as:

$$Y = A_t L^c K^b$$

The mathematical form of this function, however, is to be discovered when the multiple regression technique is applied to data obtained from primary sources.

In estimating the production function (Cobb-Douglas production function), eight possible situations could be utilized concerning the data, as follows: all variables measured in physical terms; all variables measured in value terms; output measured in physical terms while inputs are in value terms; output measured in value terms and factor inputs in physical terms; output measured in value terms and one factor input in value terms and the other in physical terms; output measured in physical terms and one factor input in value terms while the other is in physical terms.

In this section, the case used is when output is measured in physical terms, while labour input is measured in man-hours and capital in value terms. In such a case, the variable measured in value terms must

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1. Michael K. Evans, Macroeconomic Activity, (New York: Harper and Row Publishers, 1969), pp. 244-245.

be deflated to account for inflation.[1]

Annual data covering the period 1960 to 1974 on output, labour and capital inputs are obtained. At this stage, some assumptions are required. Firstly, the total assets of the JPMC are assumed to represent the capital input, and secondly, it is assumed that there are 286 working days in each year and that there are 8 working hours in each day (see Appendix VI. F).[2] The statistical results are presented in Table VI. 2. These results were selected from many different trials that yielded a number of production functions.

The multiple regression analysis yielded a logarithmic relationship between output and inputs. The function obtained can be mathematically represented by the following equation:

$$\ln Y = -3.129 + \underset{(0.095)}{0.39} \ln L + \underset{(0.199)}{0.73} \ln K \quad \ldots\ldots \quad (1)$$

For comparison purposes, the same procedure and assumptions were used to obtain a production function for the cement industry in Jordan: another main industry in the country. The analysis yielded, under a similar situation, a production function which can be represented as:

$$\ln Y = -9.55 + \underset{(0.3)}{1.59} \ln L + \underset{(0.2)}{0.05} \ln K \quad \ldots\ldots \quad (2)$$

The results of both functions are generally satisfactory. Moreover, the following characteristics of both estimated functions can be noted:

1. The partial coefficients of labour and capital inputs for the phosphate rock industry are statistically significant while for the cement industry only the partial coefficient for labour input is significant.

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1. Cost-of-living price index is used to deflate money values, since a wholesale price index is not available in Jordan.

2. For data on the cement industry, see, Appendix VI. G.

TABLE VI. 2.

Statistical Results of the Estimated Production Functions of the Phosphate Rock Industry and the Cement Industry in Jordan

Coefficients	The Estimated Model for the Phosphate Rock Industry	The Estimated Model for the Cement Industry
A_t	- 3.129	- 9.55
(b)	+ 0.73 (0.095)*	+ 0.05 (0.20)*
(c)	+ 0.39 (0.199)*	+ 1.59 (0.30)*
t-statistic for Capital input	7.615	0.25
t-statistic for Labour input	1.974	5.10
Adjusted coefficient of determination (R-2)	0.854	0.98
Durbin Watson statistic (D/W)	1.395	0.10

where: A_t, (b) and (c) are as defined at an earlier stage and (*) is the standard error of estimate of input variables.

Source: Computer runs.

These conclusions can be deduced from the application of the t-test at a 5 percent significance level. The t-statistics for the coefficients of labour and capital inputs in the production function for the phosphate industry and the labour input coefficient in the production finction for the cement industry are found to be greater than the critical value of the t-statistic at that level, namely (1.60 to 1.70), given 15 observations in the case of the phosphate industry and 18 observations in the case of the cement industry.[1] The t-statistic of the coefficient of capital input in the production function for the cement industry, however, is less than the critical value.

2. The phosphate industry is found to be capital intensive rather than labour intensive because the elasticity of production with respect to capital is greater than that to labour. The cement industry is, however, labour intensive because the elasticity of production with respect to labour is greater than that to capital. These conclusions are expected since the phosphate industry depends on large injections of capital to provide and maintain the complex installations and sophisticated machinery. In the case of the cement industry, the technology of production is simple and does not require complicated machinery.

3. Input elasticities refer to proportional changes in output due to proportional changes in the given inputs.[2] They can be written as:

$$E_L = \frac{dY.L}{dL.Y} = c \quad \text{(input elasticity of labour)}$$

$$E_K = \frac{dY.K}{dK.Y} = b \quad \text{(input elasticity of capital)}$$

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1. Taro Yamane, Statistics: An Introductory Analysis, (New York: Harper and Row Publishers, 1964), pp. 415-417.

2. Ibid., pp. 416-420.

The regression coefficient directly estimates input elasticities. The sum of input elasticities gives the scale elasticity or the returns to scale ($U = c + b$). Both estimated functions, therefore, exhibit increasing returns to scale because the scale elasticity in each case is greater than unity. This means that in both industries output increases at more than a proportional rate when inputs are increased. This situation leads to an increase in costs with increasing production, but at a decreasing rate.

4. Both functions fit satisfactorily since the adjusted coefficients of determination (R^{-2}) are found to be 85.4 and 98 percent for the phosphate industry and the cement industry respectively. R^{-2} values show the percentage change in the dependent variable which is explained by the changes in the independent variables adjusted to the degrees of freedom.[1]

5. The production function estimated for the phosphate industry does have a serial correlation problem since the Durbin-Watson statistic value is found to be less than the critical Durbin-Watson statistic, (1.60). Its value in the case of the cement industry, is very near to the critical D/W value and so we can conclude that the function for the cement industry does not have such a statistical problem.

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1. Ibid., pp. 809-811.

B. PRODUCTION TRENDS OF THE JORDANIAN PHOSPHATE ROCK

At present, JPMC produces three main types of product: the phosphate rock with 70 - 72 percent T.C.P. content; the product with 73 - 75 percent T.C.P.; and the product containing 75 - 76 percent T.C.P.

The product containing 70 - 72 percent T.C.P. is produced at both the Russeifa and El-Hassa mines and is mainly used in the manufacturing of superphosphates and phosphoric acid. This product is characterised by a low chlorine content. On the other hand, the products with 73 - 75 and 75 - 76 percent T.C.P. content are only produced at El-Hassa mines. They are basically used for the manufacturing of phosphoric acid. However, the product containing 75 - 76 percent T.C.P. requires small portions of active silica when used in the manufacturing of phosphoric acid.

The JPMC also produces other types of phosphate rock with low T.C.P. content. These low grade products, however, are stored in the open vicinity of the mines for future utilization. These products need processing to improve their T.C.P. content, ranging between 55 - 60 and 66 - 68 percent, before being marketed.

Phosphate rock production in Jordan generally increased over the period 1939 to 1968, from one ton to 1.6 million tons (see, Table VI. 3.). The production level fell during the period 1968 to 1971 and reached 0.786 million tons by 1971, a decline of 52 percent. This decline in production is believed to have resulted from the instability in the economic and political conditions of the Middle East and especially the consequences of the civil disturbances of 1970/1971 in Jordan. However, the situation improved between 1971 and 1974, when the level of production rose to 1.6 million tons, an increase of 104 percent. In 1975, the production level fell by 14.3 percent as a result of the decline in the world demand for phosphate rock.

TABLE VI. 3.

Production of Jordanian Phosphate Rock for Selected Years

(in Metric Tons)

Year	Quantity	Year	Quantity	Year	Quantity
1939	1	1955	n.a.*	1969	1,320,610
1940	6	1960	391,640	1970	1,099,179
1941	2	1965	850,145	1971	786,360
1942	2,819	1966	1,014,202	1972	1,085,019
1945	4,949	1967	1,254,026	1973	1,523,908
1950	n.a.*	1968	1,611,048	1974	1,600,000
				1975	1,400,000

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* n.a. - not available

Sources: (i) Mirko Lamer (ed.), The World Fertilizer Economy, (Palo Alto: Food Research Institute at Stanford University, 1957), p. 305 for data on production during the period 1939 to 1945.

(ii) Jordan Phosphate Mines Company, Annual Reports, 1960-1973, for data on production for the years 1960 to 1973.

(iii) Al-Dustur, No. 3129, 13th April 1976 (a Jordanian daily Newspaper), for data on production for the years 1974 and 1975.

At present, the production capacity of the JPMC is estimated at well over 2 million tons per annum. Whether this volume is actually achieved depends on the outlook of exports, since the bulk of Jordanian output is currently being exported.

The Jordanian phosphate rock industry produces an average of about 2 percent annually of the world output of phosphate rock, whereas the Moroccan phosphate rock industry accounts for about 13 percent. The Arab world as a whole, contributes about 19 percent to world output of phosphate rock (see, Table VI. 4) The production of phosphate rock from the Arab countries comes mainly from Morocco, Tunisia and Jordan. As shown in Table VI. 4 , Morocco is responsible for producing an annual average of 71 percent of total Arab production of phosphate rock, whereas Jordan contributes only 7 percent annually.

In view of the forecasts of much greater consumption of phosphate rock in Asian and European markets, the JPMC formulated plans for expanding its phosphate rock production to meet the higher levels of world demand and realise higher income. Improvements in the phosphate rock industry will undoubtedly reflect positively on the economic welfare of Jordan through forward and backward integration and the policies of diversification.

Future developments in the Jordanian phosphate rock industry are either already under way or still in the process of being investigated for economic feasibility. The major developmental plans include:

a. El-Hassa Millsite No. 1 Expansion Project:

In 1973, the management of JPMC decided that by 1980, the production capacity of El-Hassa Millsite No. 1 should reach 3.1 million tons per year of the C-grade dry product. By 1975, all major requirements for the project had been ordered and partially delivered.[1] Moreover, two

1. The original project aimed at producing 2 million tons per year of which one million tons are of the beneficated C 73/75 grade product and the remaining one million tons are of the S 70/75 grade product. In view of recent marketing trends this project has been modified as explained above.

TABLE IV. 4.

Production of Phosphate Rock in Jordan, Morocco and All Arab Countries in Relation to World Output of Phosphate Rock, 1966-1975

Year	World	Jordan	Percentage of the World	Morocco	Percentage of the World	Arab Countries	Percentage of the World
1966	74,910	1,001	1.34	9,428	12.59	14,484	19.34
1970	85,850	1,099	1.28	11,424	13.31	16,566	19.30
1973	98,000	1,524	1.56	-	-	23,520	24.00
1974	110,100	1,600	1.45	19,200	17.44	26,700	24.25
1975	105,300	1,400	1.33	13,500	12.82	19,100	18.14

Sources: (i) United Nations, Statistical Yearbook, 1974, (New York: U.N. Publications, 1973), for the years 1966 and 1970.

(ii) Al-Dustur, No. 3129, 13th April 1976, (A Jordanian daily Newspaper), for the years 1974 and 1975.

benefication units and two drying units were almost completed. The crushing plants and the train loading terminal are still to be completed.[1]

b. The Implementation of El-Hassa Millsites No. 2 and No. 3 Projects

The JPMC decided in 1975 to implement the modified Millsite No. 2 project which aims at producing 1.5 million tons per year of the C 73 - 75 grade product and dropping the production of the S-grade product because of its high chlorine content. This project was planned to commence in the second half of 1977. Equipment for this project has already been tendered and partially ordered. However, further progress in construction depends on obtaining finance from external sources. The same applies to Millsite No. 3 project, which is expected to start production in 1978 and reach a target of 2 million tons per year by 1979.

c. The Shydieh Project

Shydieh is located about 120 km. from Aqaba. The area is still under exploration, but its rapidly growing reserves of exploitable ore offer prospects of great economic potential. The deposits discovered at Shydieh contain three types of rock and require open-pit mining. They require different technology in order to produce marketable grades of rock. Production in this area is scheduled to commence in 1980 with an initial capacity of 2.5 to 3 million tons per year of dry product. Another factor that gives greater importance to Shydieh deposits is their proximity to the port of Aqaba.

The development plans of JPMC are justified by the already proved extractable ore reserves and the world market situation for phosphate rock. The proven raw material reserves at Millsite No. 1 are about

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1. Equipment is usually bought from the United States and European countries. For example, the British Taylor Woodrow Group has a £4.5 million contract to design, supply and install phosphate benefication plants for the JPMC.

50 million tons distributed as indicated in Table VII. 2. Approximately 32.7 million tons of the total are exploitable. This proportion covers the target of 18.3 million tons to be produced during the period 1974 to 1979. The ore reserves, therefore, considering the 7.2 million tons of indicated reserves and the 16.5 million tons of inferred reserves, are expected to be sufficient to last until 1987. Hence, these reserves are sufficient to justify the capital requirements called for in the expansion programme.

The proven ore reserves at both Millsites No. 2 and No. 3 of 26 million tons and the 32 million tons of potential reserves as shown in Table VII. 2., are sufficient to justify the capital expenditure needed to implement these projects, especially when bearing in mind that the installations of both projects are transportable. The expected lives of both Millsites are 7 and 13 years respectively.

The expansion of Millsite No. 1 and the construction of Millsite No. 2 require a total investment of J.D. 27.2 million. The investment schedule is shown in Table VI. 5. The JPMC has financed the required capital for 1975 and at the same time has applied for J D 8.2 million as a third-party loan finance from Abu Dhabi for the expansion of Millsite No. 1 project, and an additional J D 7.8 million as a third-party loan finance from the Kuwait Fund for the construction of Millsite No. 2. The Kuwait Fund has agreed to provide J D 7.8 million, whereas the Abu Dhabi Fund for Arab Economic Development has not yet agreed to provide the loan applied for. This clearly shows that about 59 percent of the total required capital for the two projects represent third-party loans. This corresponds to gearing ratios of:[1]

74:26 for Millsite No. 2 project
49:51 for Millsite No. 1 project
59:41 for both investments
45:55 with respect to total capitalisation of the JPMC.

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1. The gearing ratio is the ratio of debt to equity capital.

TABLE VI. 5.

Total Finance Required and the Investment Schedule, 1975-1978

(in Million Jordan Dinars)

	1975	1976	1977	1978	Total
Millsite No. 1	6.8	5.8	3.4	0.6	16.6
Millsite No. 2	0.9	4.5	5.2	-	10.6
Total	7.7	10.3	8.6	0.6	27.2

Source: Kingdom of Jordan, The Jordan Phosphate Mines Company, (Amman, 1976).

The JPMC has assumed an 8 percent interest rate and a ten-year repayment period, starting in 1978, for both loans.

In order to gain a better understanding of the main developments in the Moroccan phosphate rock industry, some background information about the Moroccan economy is presented, illustrating how it differs from the economy of Jordan.

Morocco is an Arab country in North Africa with a population of 16.88 million in 1974. The Gross National Product at market prices grew from U.S. $ 2982 million in 1970 to U.S. $ 5952 million in 1974, a rise of 99.6 percent (see, Table VI. 6). Between 1970 and 1974, G.D.P. at constant prices grew at 4.7 percent, whereas the per capita income rose by 1.5 percent per year. The real growth in agriculture and industry was 1.4 percent and 5.6 percent per year respectively during the same period. The contribution of each economic sector to G.D.P. in 1970 was as follows: agriculture 30.8 percent; mining, quarying and industry 27.3 percent; and services 41.9 percent (see, Table VI. 7). The table also shows that the sectoral contribution to G.D.P. had not changed significantly by 1973.

Table VI. 8. indicates that Government and private consumption constituted 15 percent and 74 percent respectively of G.D.P. in 1973 and 15 percent and 69 percent respectively in 1974. Gross capital formation, on the other hand, constituted 14 percent of G.D.P. in 1973 and 16 percent in 1974. Imports and exports of goods and services each constituted 35 percent of G.D.P. in 1974. Exports of phosphate rock, however, amounted to 18.7 million tons in the same year. Phosphate rock production in Morocco is currently centred in two areas, namely the Khouribga area and the Youssoufia area. Output from the Khouribga area accounts for about 80 percent of Morocco's production capacity of phosphate rock, consisting of rock grades of 72 percent, 75 percent, 80 percent and 76 - 77 percent

TABLE VI. 6.

Population and Gross National Product of Jordan and Morocco

Period	Population (in millions)		Gross National Product at Market Price (in millions of domestic currency)		Exchange Rates Domestic Currency/ U.S. $		Gross National Product at Market Price (in millions of U.S. $)	
	Jordan	Morocco	Jordan	Morocco	Jordan	Morocco	Jordan	Morocco
1970	2.30	15.52	222.5	15600	0.3571	5.03	623	2982
1971	2.38	n.a.	236.6	16600	0.3571	4.76	665	3487
1972	2.46	15.85	263.0	18300	0.3571	4.67	757	3919
1973	2.54	16.31	291.3	19400	0.3289	4.29	886	4522
1974	2.62	16.88	373.9	24700	0.3150	4.15	1187	5952
Average Annual Percentage Change Between 1970 and 1974	+ 2.8	+ 2.2	+ 13.6	+ 11.7	-	-	-	-

Sources: (i) United Nations, Monthly Bulletin of Statistics, Vol. XXX, No. 4 ,(New York: April, 1976), p. 3.

(ii) United Nations, Monthly Bulletin of Statistics, Vol. XXX, No. 4 ,(New York: April, 1976), pp. 216-217.

(iii) United Nations, Statistical Yearbook 1976 (New York: United Nations Publications, 1977), pp. 645-646.

TABLE VI. 7.

Percentage Contribution of Economic Sectors to G.D.P. in Jordan and Morocco

Economic Sector	1970		1973	
	Jordan	Morocco	Jordan	Morocco
Agriculture	15.1	30.8	13.7	27.0
Mining, quarrying and Industry	15.8	27.3	20.2	31.0
Services	69.1	41.9	66.1	42.0

Sources: (i) Table V. 10.

(ii) Arab Central Statistical Bureau, Statistical Yearbook For Arab Countries, 1976, (Cairo: April, 1976), p. 187, table no. 4,2,1,13.

(iii) Bank of Morocco, Annual Report, 1973, (Rabat: Ekdal Press, 1973), pp. 5-27.

TABLE VI. 8.

Some Economic Indicators as a Percentage of G.D.P. for Jordan and Morocco

	G.D.P. (in million U.S. $)	Government Consumption As Percentage of G.D.P.	Private Consumption As Percentage of G·D.P.	Increase in Stocks as Percentage of G.D.P.	Gross Fixed Capital Formation As Percentage of G.D.P.	Exports of Goods and Services As Percentage of G.D.P.	Imports of Goods and Services As Percentage of G.D.P.
1973 (Morocco)	4965	15	74	- 2	14	25	26
1973 (Jordan)	816	31	82	0	19	19	51
1974 (Morocco)	6434	15	69	1	16	35	35
1974 (Jordan)	1086	29	75	4	21	25	54

Source: United Nations, Statistical Yearbook, 1976,(New York: U.N. Publications, 1977), pp. 653-655.

of B.P.L. content. Production from this area is expected to reach 18 million tons per year as of 1977. The Youssoufia area, on the other hand, is expected to produce about 7 million tons per year as of 1977. Therefore, Morocco is planning to produce in total 23 million tons in 1976, 26 million tons by 1977 and about 30 million tons by 1980.

At present, trial operations are being carried out in the south of Youssoufia area. The results of these trials have not yet been announced.

In addition to these expansion plans, there are definite plans to operate new mines at Ben Guerir, Sidi Hajjaj, and Meskala with production targets of 10 million tons of phosphate rock per year from each area. The production target for Ben Guerir and Sidi Hajjaj is hoped to be reached by 1980, and for Meskala by 1990. A new port is under construction at Sidi Hajjaj. It is expected to operate by 1980.

PART FIVE: THE STRUCTURE OF COSTS

For a better understanding of the cost dimension, the total cost is divided into its components, namely, production costs, administrative costs, and marketing or transport costs (see, Table VI. 9.). During the period 1962 to 1975, 51 percent of the total cost was production costs, 7 percent administrative costs and 42 percent marketing costs. The relative weight of each component remained virtually unchanged. Table VI. 10 shows that a direct relationship existed between the level of output and production costs, with the exception of 1975 when production costs increased by approximately JD 650,000 at a time when output declined by about 230,000 tons. This may be partially explained by the fact that a large depreciation allowance was charged against profits as production costs. The table also indicates that the unit production costs were almost stable from 1962 to 1970, but rose from JD 1.751 in 1970 to JD 2.439 in 1971, although output dropped by approximately 50 percent during 1970/1971.

TABLE VI. 9.

Production and Administrative Costs for the Phosphate Rock Industry in Jordan, 1962-1975

(Quantities in tons and costs in Jordanian Dinars)

Year	Quantity	Production Costs	Production Unit Cost	Administrative Costs	Administrative Unit Cost
1962	681,010	933,917	1.371	123,230	0.181
1963	626,899	815,249	1.300	156,949	0.250
1964	613,568	766,828	1.250	144,898	0.236
1965	850,145	982,518	1.160	199,740	0.235
1966	1,014,202	1,440,626	1.420	174,342	0.172
1967	1,254,026	1,839,431	1.467	322,623	0.257
1968	1,611,048	2,259,852	1.403	387,234	0.240
1969	1,324,904	2,337,659	1.764	313,768	0.237
1970	1,099,179	1,924,475	1.751	301,997	0.275
1971	528,889	1,289,847	2.439	296,280	0.560
1972	700,170	1,579,964	2.257	259,986	0.371
1973	1,127,594	2,157,650	1.913	165,182	0.146
1974	1,606,832	3,881,788	2.416	421,237	0.262
1975	1,377,315	4,532,933	3.291	529,140	0.384

Sources: (i) Kingdom of Jordan, Jordan Phosphate Mines Company, Annual Reports, 1962-1975, (Amman).

(ii) Kingdom of Jordan, JPMC, (Amman).

TABLE VI. 10.

Major Components of Total Cost for the Jordanian Phosphate Rock Industry, 1962-1975

(in Jordan Dinars)

	Production Costs		Administrative Costs		Marketing Costs		
Year	Amount	% of Total Cost	Amount	% of Total Cost	Amount	% of Total Cost	Total Cost
1962	933,917	56	123,230	7	625,749	37	1,682,896
1963	815,249	55	156,949	10	524,765	35	1,496,963
1964	766,828	41	144,898	8	957,362	51	1,869,088
1965	982,518	51	119,740	6	812,264	43	1,914,522
1966	1,440,626	57	174,342	7	912,954	36	2,527,922
1967	1,829,431	52	322,623	9	1,366,857	39	3,528,911
1968	1,259,852	50	387,234	9	1,860,732	41	4,507,818
1969	2,337,659	55	313,768	7	1,585,663	38	4,237,090
1970	1,924,475	54	301,997	9	1,330,704	37	3,557,176
1971	1,289,847	46	296,280	11	186,776	43	2,772,903
1972	1,579,964	45	259,986	8	1,644,009	47	3,483,959
1973	2,157,650	50	165,182	4	2,000,633	46	4,323,465
1974	3,881,788	47	421,237	5	4,006,588	48	8,309,613
1975	4,532,933	52	529,140	6	3,690,451	42	8,752,524
Average 1962/1975		51		7		42	

Sources: (i) Kingdom of Jordan, Jordan Phosphate Mines Company, Annual Reports, 1962-1975, (Amman).

(ii) Kingdom of Jordan, JPMC, (Amman).

Marketing costs are not related to the level of output. In relative terms, they stayed within their long range bounds, though in absolute terms they increased marginally. Table VI. 11 shows that the level of sales and the unit marketing cost are directly related. The unit marketing cost did not exhibit the same degree of stability between 1962 and 1975 as the unit production cost. The unit marketing cost moved within relatively narrow bounds until the early 1970s. The percentage increase in marketing costs is explained by the rise in shipping rates. Therefore, the present high unit cost of phosphate rock output is largely attributable to the high marketing costs and not to organisational incompetency.

Administrative costs, on the other hand, constituted an average of about 7 percent of total costs. The unit administrative cost rose from JD 0.181 in 1962 to JD 0.384 in 1975. This has not changed considerably in relation to the growth in output.

Therefore, total costs, as indicated in Table VI. 12 , have increased from JD 1,682,896 in 1962 to JD 8,752,524 in 1975, whereas output rose from 681,010 tons to 1,377,315 tons. Hence, the unit cost increased from JD 2.471 to JD 6.355. During the period 1970 to 1971, the unit cost rose from JD 3.236 to JD 5.243 in spite of the substantial decline in the level of output. This is attributable to the existence of high excess capacity.

PART SIX: THE ECONOMIC IMPORTANCE OF THE JORDANIAN PHOSPHATE ROCK INDUSTRY

The economic importance of the Jordanian phosphate rock industry stems from the contribution it makes to the general economic welfare of the country.

The phosphate rock industry contributes an annual average of 90 percent of the total value added generated by the mining and quarrying industries and approximately 16 percent of the value added generated by the mining

TABLE VI. 11.

Phosphate Rock Sales, Price Per Ton and Marketing Costs for JMPC 1962-1975

(Quantities in Tons and Amounts in Jordan Dinars)

	Sales			Marketing Costs	
Year	Quantity	Amount	Price Per Ton	Amount	As a Percentage of Quantity Sold
1962	371,640	1,393,200	3.749	625,749	1.684
1963	368,504	1,426,785	3.872	524,765	1.424
1964	627,074	2,387,693	3.808	957,362	1.527
1965	604,648	2,418,828	4.000	812,264	1.343
1966	754,736,	3,214,517	4.259	912,954	1.210
1967	881,658	3,718,416	4.218	1,366,857	1.550
1968	1,095,227	4,698,985	4.290	1,860,732	1.699
1969	928,296	3,919,509	4.222	1,585,663	1.708
1970	658,056	2,799,967	4.255	1,330,704	2.022
1971	650,833	2,689,922	4.133	1,186,776	1.823
1972	952,371	3,868,252	4.062	1,644,009	1.726
1973	1,089,518	4,706,357	4.320	2,000,633	1.836
1974	1,468,894	20,432,830	13.910	4,066,588	2.768
1975	1,111,877	21,182,032	19.051	3,690,451	3.319

Sources: (i) Kingdom of Jordan, Jordan Phosphate Mines Company, Annual Reports, 1962-1975, (Amman).

(ii) Kingdom of Jordan, JPMC, (Amman).

TABLE VI. 12.

Output, Total Cost and Selling Price Per Ton For JPMC, 1962-1975

(Quantities in Tons and Amounts in Jordan Dinars)

Year	Quantity	Total Cost	Unit-Cost	Average Price Per Ton *	
				In JD	In U.S. $
1962	681,010	1,682,896	2.47	3.749	10.50
1963	626,899	1,496,963	2.39	3.872	10.84
1964	613,568	1,869,088	3.05	3.807	10.66
1965	850,145	1,914,522	2.26	4.000	11.20
1966	1,014,202	2,527,922	2.49	4.259	11.93
1967	1,254,026	3,528,911	2.81	4.217	11.81
1968	1,611,048	4,507,818	2.80	4.290	12.01
1969	1,324,904	4,237,090	3.20	4.222	11.82
1970	1,099,179	3,557,176	3.24	4.255	11.91
1971	528,889	2,772,903	5.24	4.133	11.57
1972	700,170	3,483,959	4.98	4.062	11.37
1973	1,127,594	4,323,465	3.84	4.319	12.76
1974	1,606,832	8,309,613	5.17	12.829	40.03
1975	1,377,315	8,752,524	6.36	19.051	60.96

* For the period 1962 to 1973 each 1 JD equals U.S. $ 2.8, and after 1973 each 1 JD equals U.S. $ 3.2.

Sources: (i) Kingdom of Jordan, JPMC, Annual Reports, 1962-1975, (Amman).

(ii) Kingdom of Jordan, JPMC, (Amman).

and manufacturing sector of the economy. Hence, the phosphate rock industry is considered to be the major mineral industry in the country and one of the main industries in the mining and manufacturing sector (see, Table VI. 13).

The phosphate rock industry also contributed an annual average of 3 percent of the Gross Domestic Product of Jordan during the period 1964 to 1975, as indicated in Table VI. 14. The relatively high contribution of the industry to G.D.P. in 1974 and 1975 is attributable to the high selling average prices of the Jordanian phosphate rock in the export markets. Table VI. 14 shows that the income generated by the phosphate rock industry during the period 1964 to 1975 constituted an annual average of 24 percent of the total income generated by the mining and manufacturing sector. Moreover, it indicates that the mining and manufacturing sector contributed an annual average of 9.8 percent to G.D.P. in the same period.

The phosphate rock industry was ranked fourth among other industries when the level of output was considered for the year 1974 (see, Table VI. 15). Its output level in that year accounted for 10.9 percent of the total output of the mining and manufacturing sector. The cement and petrochemical industries, contributed 14.3 percent and 39.1 percent respectively.

The phosphate rock industry has to a certain extent helped in alleviating the problem of unemployment by offering many job opportunities (see, Table VI. 16). The marked decline in the number of employees of JPMC in 1963 and 1964 can be attributed to the modern machinery and equipment acquired at a time when large stocks of unsold rock were accruing. The apparent reasons for the decline in employment in 1970/1971 were the consequences of the civil war in the country at that time. Table VI. 17 shows that the phosphate rock industry in Jordan employed 1,644 persons

TABLE VI. 13.

The Ratio of Value Added in the Phosphate Rock Industry to the Total Value Added in Mining and Manufacturing

(Values in Jordan Dinars)

Year	Value Added in the Phosphate Rock Industry (1)	Value Added in the Mining and Manufacturing Sector (2)	Ratio of 1:2
1959	273,000	4,550,000	0.06
1968	1,763,000	19,588,888	0.09
1971	2,005,000	19,851,485	0.10
1974	19,280,000	49,006,923	0.39
Average 1959-1974			0.16

Sources: (i) Kingdom of Jordan, Department of General Statistics, Industrial Survey, 1968, (Amman: 1969).

(ii) Kingdom of Jordan, Department of General Statistics, Industrial Survey, 1971, (Amman: 1972).

(iii) Kingdom of Jordan, Department of General Statistics, Industrial Survey, 1974, (Amman: 1975).

TABLE VI. 14.

Ratios of Income from the Phosphate Rock Industry and the Mining and Manufacturing Sector to G.D.P. 1964-1975

(Values in million Jordan Dinars)

Year	Phosphate Rock Sales (1)	Income from Mining and Manufacturing (2)	Gross Domestic Product (3)	Ratio of 1:2	Ratio of 2:3	Ratio of 1:3
1964	2.39	12.53	160.7	0.19	0.08	0.02
1965	2.42	16.22	180.5	0.15	0.09	0.01
1966	3.22	17.22	183.1	0.187	0.094	0.02
1967	3.72	15.00	170.9	0.248	0.088	0.02
1968	4.70	17.4	169.1	0.27	0.103	0.03
1969	3.92	19.9	198.4	0.20	0.10	0.02
1970	2.80	17.1	186.1	0.16	0.092	0.02
1971	2.69	17.0	199.4	0.16	0.085	0.01
1972	3.87	19.8	216.2	0.20	0.092	0.02
1973	4.71	22.6	241.3	0.21	0.094	0.02
1974	20.43	44.0	319.0	0.46	0.138	0.06
1975	21.18	45.0	365.0	0.47	0.123	0.06
Average 1964-1975				0.24	0.98	0.03

Source: Kingdom of Jordan, Central Bank of Jordan, Annual Reports, 1964-1976, (Amman).

TABLE VI. 15.

The Relative Importance of the Phosphate Output to Total Industrial Output, 1974

Industry	Relative Importance (In Percentage)
Petro-chemicals	39.1
Cement	14.3
Cigarettes	11.6
Phosphates	10.9
Other Industries	24.1
Total	100.0

Source: Kingdom of Jordan, Central Bank of Jordan, Unpublished information, (Amman: 1975).

TABLE VI. 16.

The Number of Employees of the JPMC, 1959-1976

Year	Number of Employees	Year	Number of Employees
1959	1442	1968	1440
1960	1446	1969	1227
1961	1644	1970	908
1962	1805	1971	996
1963	1193	1972	1186
1964	789	1973	1496
1965	1100	1974	1906
1966	1176	1975	2514
1967	1436	1976	2866

Source: Kingdom of Jordan, JPMC, Annual Reports, 1960-1976, (Amman).

TABLE VI. 17.

Employment According to Economic Sector

Sector	1961**	% of Total	1961*	% of Total	1973*	% of Total	1975*	% of Total
Agriculture	137,757	35.3	72,952	33.5	63,157	17.63	125,000	32.9
Industry and Mining	41,932	10.8	22,278	10.2	32,208	8.99	23,000	6.1
Electricity, Gas and Water	1,572	0.4	925	0.4	1,592	0.44	8,000	2.1
Trade	31,356	8.0	17,452	8.0	55,092	15.38	25,000	6.6
Construction	40,159	10.3	22,194	10.2	30,838	8.61	2,000	0.5
Transport	11,899	3.1	7,624	3.5	24,632	6.87	17,000	4.5
Social and Personal Services	53,525	13.7	28,685	13.2	144,779	40.41	171,000	45
Unemployed							9,000	2.3
Total	389,978	100.0	217,883	100.0	358,290	100.0	380,000	100.0
Phosphate Industry	1,644	0.004	1,644	0.008	1,496	0.004	2,514	0.007

Sources: (i) Shuja Al-Asad, 'Population and Labour Force in Jordan', paper presented at the International Labour Organisation conference in Jordan, October 26-31, 1973, p. 18.

(ii) Kingdom of Jordan, Department of General Statistics, Employment Survey, 1975, (Amman: 1976).

* Figures relate to the East Bank of Jordan.

** Figures relate to the East and West Banks of Jordan.

or 0.004 percent of the total employment in the country in 1961 and 2514 persons, or 0.007 percent in 1975. However, its contribution to the employment in the mining and manufacturing industries was 4.4 percent in 1968 and 6.2 percent in 1975. It is noteworthy that the employees of the JPMC accounted for about 85 percent of the total employment in the mining and quarrying industries in 1975, compared to only 17 percent in 1961.[1]

Another contribution of the phosphate rock industry to the economic welfare of the country is the considerable foreign exchange it generates through exports. These earnings are mainly used to finance part of the plans specified in the economic and social development programmes of the Jordanian Government. Table VI. 18 shows that income from phosphate rock exports constituted 3.9 percent of the total income from foreign currencies in 1971, 12.5 percent in 1974, and 7 percent in 1975. As indicated in the Five-Year Development Plan, 1976-1980, income from phosphate rock exports is expected to cover 29.3 percent of the investments outlined in the Plan for 1976 and up to 76.8 percent of the investments for 1980 (see, Table VI. 19).

Phosphate rock exports to total exports grew from 34.0 percent in 1964 to 50.1 percent in 1975 (see, Table VI. 20). Examination of the Five-Year Plan reveals that exports of phosphate rock will continue to play a prominent role in the future by constituting up to 56.8 percent of total Jordanian exports by 1980 (see, Table VI. 21). Therefore, this industry mitigates the country's heavy reliance on foreign aid which

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1. East and West Banks of Jordan were included in the census of employment of 1961, whereas only the East Bank was included in the census of employment of 1975.

TABLE VI. 18.

Ratio of Income From Phosphate Rock Exports to Income From Foreign Currencies, 1971-1975

(in million Jordanian Dinars)

Year	Income From Foreign Currencies (1)	Income From Phosphate Rock Exports (2)	Ratio of 2:1
1971	60.22	2.35	0.039
1972	86.76	3.72	0.043
1973	111.63	4.56	0.041
1974	160.78	20.03	0.125
1975	289.09	20.11	0.07

Source: Kingdom of Jordan, Central Bank of Jordan, Annual Reports, 1971-1976, (Amman).

TABLE VI. 19.

Investments of The Five-Year Development Plan, 1976-1980

(in million Jordanian Dinars)

	1976	1977	1978	1979	1980
Total Investment	150	181	166	143	120
Income From Phosphate Rock Exports	44	61	73	87	96
Percentage Share	29.3	33.7	43.7	56.6	76.8

Source: Kingdom of Jordan, National Planning Council, Five-Year Development Plan, 1976-1980, (Amman).

TABLE VI. 20.

Ratio of Phosphate Rock Exports to Total Exports, 1964-1980

(in Million Jordanian Dinars)

Year	Phosphate Rock Exports (1)	Total Exports (2)	Ratio of 1:2
1964	2.39	7.01	0.34
1965	2.42	7.75	0.31
1966	3.22	8.76	0.37
1967	3.72	9.98	0.37
1968	4.70	12.17	0.39
1969	3.92	11.91	0.33
1970	2.80	9.31	0.30
1971	2.69	8.82	0.31
1972	3.87	12.61	0.31
1973	4.71	14.01	0.34
1974	20.43	39.44	0.52
Average 1964-1974			0.35
1975	20.107	40.075	50.1
1976	44.0	74.0	59.5
1977	61.0	93.0	65.6
1978	73.0	109.0	67.0
1979	81.0	141.0	56.8
1980	96.0	169.0	56.8

Sources: (i) Kingdom of Jordan, Central Bank of Jordan, Annual Reports, 1964-1976, (Amman).

(ii) Kingdom of Jordan, The National Planning Council, Five-Year Development Plan, 1976-1980, (Amman: 1976), p. 49.

TABLE VI. 21.

Production of Superphosphates and Jorphos, 1961-1976

(in tons)

Year	Superphosphates	Jorphos
1961	141	3,401
1962	524	n.a.
1963	674	10,789
1964	1,297	8,409
1965	2,697	5,020
1966	2,204	11,232
1967	769	17,029
1968	n.a.	20,182
1969	n.a.	4,294
1970	n.a.	n.a.
1971	1,066	1,362
1972	n.a.	6,340
1973	7,345	12,331
1974	n.a.	6,832
1975	n.a.	15,790
1976	9,230	18,570

n.a. - figures not available

Source: Kingdom of Jordan JPMC, Annual Reports, 1961-1976, (Amman).

constitutes a high proportion of the Government budget. Moreover, it contributes to Jordan's international position by promoting economic and commercial co-operation with her customers such as Yugoslavia, Ceylon, Czechoslovakia, Bulgaria and Turkey.

The agricultural sector has undoubtedly benefited from the phsophate rock industry. In 1960, JPMC established a small plant for manufacturing superphosphates. Between 1961 and 1964, the company produced an annual average of 600 tons. Jordanian farmers used to pay JD 23 per ton for imported superphosphates before the establishment of this plant. However, they only paid JD 2.870 per ton for locally produced superphosphates during the period 1961 to 1964. In 1976, the company produced 9,230 tons of superphosphates (see, Table VI. 22). In addition to the superphosphates, the JPMC produces the crushed phosphate fertilizer known as 'Jorphos'. Production of Jorphos rose from 3,401 tons in 1961 to 18,570 tons in 1976 (see, Table VI. 21).

The phosphate rock industry has also contributed to the development of other industries by acquiring shares of their paid-up capital (see, Table VI. 22). Moreover, the JPMC is also one of the main shareholders in the chemical fertilizer industry which is still under construction. The chemical fertilizer industry has been established mainly to utilize the low-grade phosphate products. Nevertheless, it is also equipped to use the high grades. The target for this industry is to produce 900 tons per day of ammonium phosphates and superphosphates. Moreover, this industry will provide jobs for a labour force of 750 and is expected to earn some JD 20 million a year by 1979.[1] In addition, it will save some foreign exchange that otherwise would be used to finance imports of fertilizers.

The phosphate rock industry also helped to increase commercial and

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1. Al-Tanmieh Magazin, The Chemical Fertilizer Industry, p. 89, No. 260, April/May, 1975 (a Jordanian Magazine).

TABLE VI. 22.

Participation of JPMC in Other Industries, 1964-1974

(in Jordanian Dinars)

Year	Participation (1)	Paid Up Capital (2)	Ratio of 1:2
1964	68,280	12,000,000	0.056
1965	68,280	3,000,000	0.022
1966	73,280	3,000,000	0.024
1967	58,280	3,000,000	0.019
1968	58,280	3,000,000	0.019
1969	58,280	3,000,000	0.019
1970	58,280	3,000,000	0.019
1971	58,280	3,000,000	0.019
1972	58,280	3,000,000	0.019
1973	61,395	6,000,000	0.010
1974	87,357	6,000,000	0.014

Source: Kingdom of Jordan, JPMC, Annual Reports, 1965-1975, (Amman).

economic activity in areas where phosphates are mined. The Russeifa area was almost deserted before phosphates were mined there. However, the village has grown substantially during the last two decades. Similar changes have occurred in the El-Hassa area. Benefits have also accrued to the transportation industry, which has been kept busy. Trucking charges between Amman and Aqaba have been reduced, for trucks hauling phosphate rock to Aqaba now carry imported goods on their return journey to Amman at a cost usually lower than it would have been had they travelled especially to the port to bring back the imported goods.

Finally, the phosphate rock industry provides income to the Government consisting of: the return on Government stocks; a 35 percent income tax; a 10 percent surcharge for social security; and mining duty.[1] Table VI. 23 reveals that such income grew from JD 429,000 in 1966 to JD 12,820,000 in 1975.

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1. The mining duty has been imposed since 1974. It was JD 6 per ton in 1974 and was increased to JD 11 per ton in 1975.

TABLE VI. 23.

Gross Income To Government From the Phosphate Rock Industry, 1966-1975

(in thousand of Jordanian Dinars)

Year	Return on Shares	Income and Services Tax	Mining Fee	Total
1966	154.0	275.0	-	429.0
1967	123.1	92.0	-	215.1
1968	154.0	-	-	154.0
1969	-	41.6	-	41.6
1970	-	128.2	-	128.2
1971	-	-		-
1972	-	44.5	-	44.5
1973	-	81.4	-	81.4
1974	980.8	2,122.1	6,910.0	10,012.9
1975	1,068.5	728.1	11,024.0	12,820.6

Source: Kingdom of Jordan, JPMC, (Amman).

PART SEVEN: SUMMARY AND CONCLUSION

(i) Although the area of potential phosphate deposits covers about 60 percent of Jordan, exploitation is only taking place in the Russeifa and El-Hassa areas. Plans to extend phosphate ore mining to the Shydieh area exist, and exploitations of deposits in that area is scheduled for 1980.

(ii) Open-pit and underground mining methods are used at both Russeifa and El-Hassa. However, underground mining is now being phased out. Furthermore, the technology used in each area is somewhat different because of the different mineralogical composition of ores.

(iii) The level of phosphate rock reserves in Jordan is estimated to be about 2 billion tons, 265.5 million tons of which are confirmed. This level is expected to increase substantially in future years as a result of the extensive exploration currently taking place.

(iv) The JPMC produces a number of different types of phosphate rock, ranging from 55 - 60 percent T.C.P. content to 75 - 76 percent T.C.P. content. However, recently production has been concentrated on the higher grade ore in response to world demand for high quality phosphate rock. The production capacity of JPMC is well over 2 million tons per year. Production in 1976 reached 1.7 million tons, (about 2 percent of world output and 14 percent of output from the Arab producing countries). Plans for expansion are underway and by 1980 JPMC aims to produce 7 million tons per year. It is doubtful, however, whether JPMC will be able to market its proposed production, considering the present and future world demand for phosphate rock.

(v) The total unit cost has increase substantially over the period under study. The main reason for this growth has been the substantial increases in marketing and production costs. Analysis of the cost structure during the period 1962 to 1975 indicates that, on average, 51 percent of

total costs represented production costs, 7 percent administrative costs, and 42 percent marketing costs.

(vi) The phosphate rock industry plays an important role in the process of economic development of Jordan by contributing to G.N.P., providing job opportunities and earning foreign exchange. This industry will continue to be the country's largest industrial employer and foreign exchange earner. In addition, it will continue to provide direct and indirect benefits to the economy through forward and backward integration and diversification.

CHAPTER SEVEN: ORGANIZATIONAL ASPECTS OF THE JORDANIAN PHOSPHATE ROCK INDUSTRY.

This chapter is concerned with organizational aspects of the phosphate rock industry in Jordan. It provides a detailed analysis on the organization structure, management, labour force and performance of the J.P.M.C.

PART ONE: THE ORGANIZATION STRUCTURE AND MANAGEMENT OF J.P.M.C.

Phosphate deposits were first discovered in Jordan in 1908, during the construction of the Hedjaz Railway connecting Jordan with Saudi Arabia. The exploration of this resource was only started, at a small scale, in 1934 by some Jordanian private contractors. In 1938, a privately owned company, The Trans-Jordanian Phosphate Mines Limited, was formed and was granted an exclusive 30-year concession to exploit the phosphate deposits in the Russeifa area. During its first ten years of operation, the company was able to produce only limited amounts of phosphate rock because of the primitive mining methods employed. In 1948, the mining activities of the company came to a halt as a result of the Palestinian War and its consequences.

However, in 1953, a major change took place when the company was reincorporated as a public corporation with an equity capital of one million Jordan Dinars divided into one million shares.[1] The Jordan Government at that time acquired a minority shareholding by paying for only one-third of the shares and reserving another one-half. In 1960, the Government gained control of the J.P.M.C. and therefore, of the phosphate rock industry since the J.P.M.C. was the sole producer.

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1. Prior to 1953, the paid-up capital of the company amounted to J.D. 400,000 of which J.D. 25,000 were owned by the Jordan Government and the balance by private investors.

It acquired the new 200,000 equity shares of the company and thus became the major shareholder owning 50·4 per cent of the paid-up capital of the company.

In 1962, the Government decided to expand mining operations to the El-Hassa area.[1] It gave the lease to the J.P.M.C. and decided that all present and future mining activities for phosphate rock were to be handled by the J.P.M.C. This, meant the creation of a monopoly controlled by the Government. In a country like Jordan, where capital resources are limited and private savings are low, the advantages of developing an already existing firm outweigh the disadvantages of creating a monopoly, particularly in an industry which is capital intensive. The decision by the Government to give the lease to the J.P.M.C. therefore, meant: more capital resources could be made available for development; the Government had more control over this important industry; better prospects in external markets; and better utilization of the economies of scale. However, the creation of another firm might have resulted in greater efficiency due to competition.

During the period 1965 to 1975, the equity capital of the J.P.M.C. rose from JD 3 million to JD 10 million, an increase of 233 per cent. The share of the Government, however, rose from 63 per cent to 81·44 per cent. The remaining equity shares of 1975 were owned by only 1100 private investors.

The organization of the J.P.M.C, in its present form, is headed by a ten member Board of Directors including a Chairman and a Vice-Chairman. The authority to appoint seven members of the Board is vested in the Council of Ministers upon a recommendation of the Minister of Commerce and Industry.

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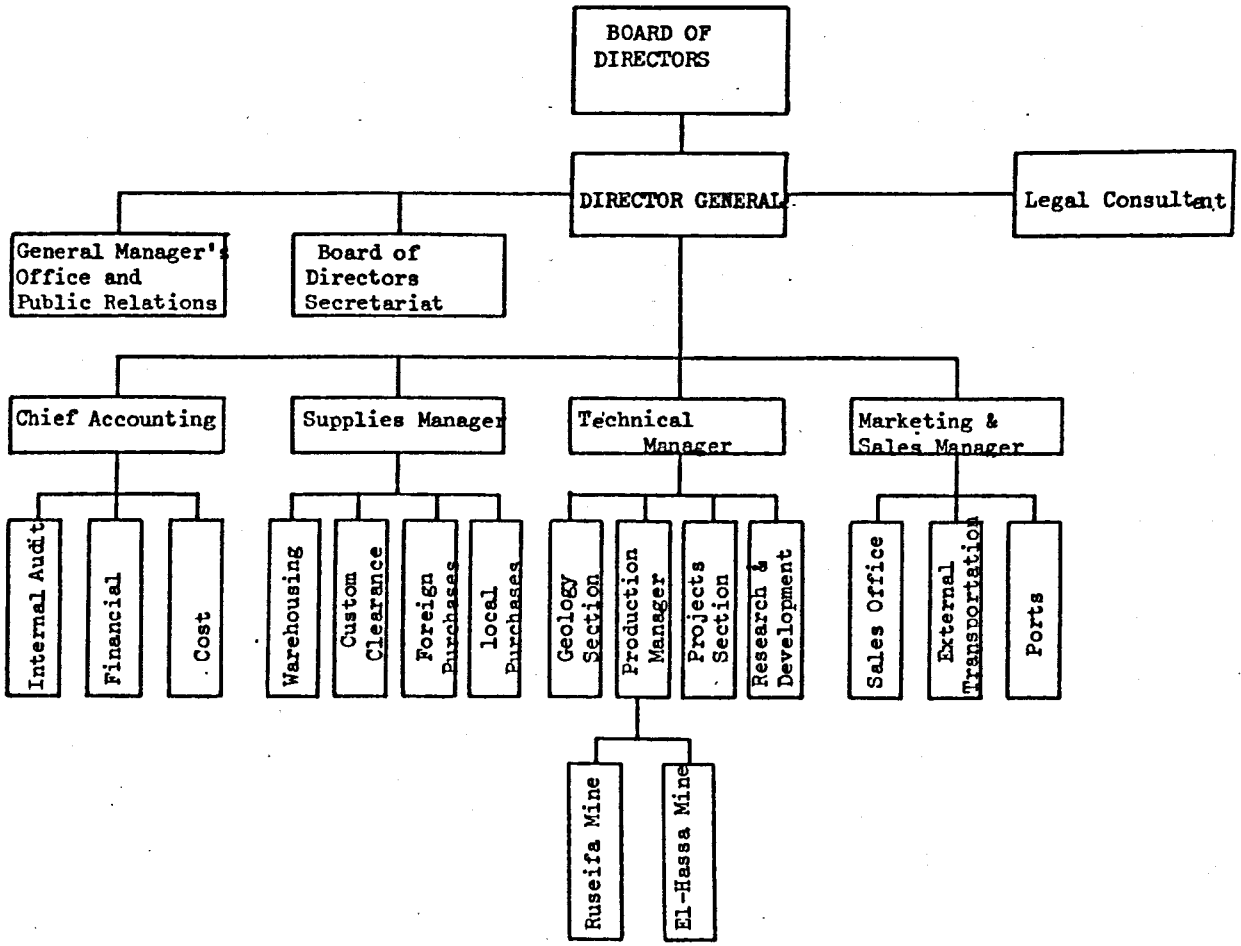
1. The decision was taken upon the recommendations of a feasibility study sponsored by the Jordan Government and carried out by Parson's Corporation, an American Consulting firm.

The remaining members of the Board are elected by the private shareholders. The term of office for the Board is three years. However, recently, it has become rare for the Board to serve its full term due to differences in opinion between the Chairman and the Director General, and the Council of Ministers. Basically, the Board is responsible for dealing with general policy matters, leaving daily affairs to be handled by the Director General who is closely supervised by the Chairman of the Board.

Figure VII.a shows that the J.P.M.C. consists of four functional departments each headed by a manager who is closely supervised by the Director General. The Marketing and Sales Department is responsible for all marketing and related functions. However, there is a shortage of qualified staff necessary to implement a sales policy of the magnitude contemplated in the production plans. The second department is the Supplies Department which has basically the same problem as that, of the Sales Department. Thirdly, the Accounts Department, whose weakness has resulted from the lack of attention paid to cost control because of the emphasis placed on production by the technicians who have generally run the company. When losses have been made, the company has been subsidised by the Government, while in profitable periods management has regarded cost control as an unnecessary operation. The existing accounting procedures are rudimentary and mostly concerned with general ledger work and the preparation of financial statements. The J.P.M.C. has not yet used computer facilities for its accounting, although plans to do so are being prepared.

It is probable that a disproportionate amount of manpower is allocated to inventory and the pay roll. Although the company has an adequate cost accounting system, cost sheets are often delayed up to six months and are frequently incomplete or inaccurate. Hence these sheets are usually

FIGURE VII.a - THE ORGANIZATION CHART OF JPMC



Source: Kingdom of Jordan, JPMC,

ignored by top management when a decision is to be made. The weaknesses of the Accounts Department can be attributed to the general weakness of accounting procedures in Jordan where accounting is a low status occupation. As such, it does not attract recruits of high calibre. The pay scales for accountants are similar to technicians rather than to fully qualified professionals (See, Table VII.1). In addition, the rate of increase in accountants' salaries has been considerably slower than that in other professions. The present pay structure of the J.P.M.C. reflects the low priority generally given to accounting in Jordan.[1] Of the thirty accountants employed by the J.P.M.C. in 1975, only five had received a post-secondary education. However, the problem is eased by the fact that accountants tend to stay with the company for long periods because of the limited opportunities elsewhere. The degree to which this problem is eased depends on the level of experience that can actually compensate for the lack of formal training.

The fourth department is the Technical Department which consists of four sections: Research and Development; Projects; Geology; and Production. The first section is responsible for testing rock samples and finished products. However, judging from the number and quality of personnel working in this section, it could be argued that unless more and better qualified staff are employed in this section, no basic research is likely to be carried out.

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1. An accountant working at El-Hassa mines earns less than half that of a chief surveyor.

TABLE VII.1.

AVERAGE DAILY WAGE RATES FOR MALE WORKERS IN JORDAN (JD/DAY)

CATEGORY	1970	1975	PERCENTAGE CHANGE 1975 / 1970
Mining Engineer	3.3	5.9	+ 79
Chemical Engineer	3.4	5.4	+ 59
Metallurgist	3.6	5.2	+ 50
Sales Manager	2.3	5.0	+117
Civil Engineer	3.7	4.8	+ 30
Electrical Engineer	4.0	4.8	+ 20
Mechanical Engineer	3.2	4.8	+ 50
Welder	0.6	4.2	+567
Chemical Engineering Technician	1.4	3.1	+121
Earth Moving Machine Operator	1.1	2.2	+100
Accountant	1.5	2.0	+ 33
Civil Engineering Technician	1.3	1.9	+ 46
General Foreman	1.2	1.8	+ 50

Source: Kingdom of Jordan, Department of General Statistics, (Amman: 1976).

The Projects Section is also understaffed and it only prepares studies on small-scale projects. When a large-scale study is required, the J.P.M.C usually invites outside consultants, usually foreign, to undertake it. In this case, the Projects Section acts as a centre for collecting the data required by the consultants. The Production Section is considered the largest and the most important, although it is ranked at the same level as the other sections in the organization chart. The Production Section is headed by a manager who is often an engineer. He has direct access to the Director General and also liaises with the mine managers at Russeifa and El-Hassa. He receives production orders from the technical manager or typically from the Director General, and transmits them to the mine managers. He also receives reports concerning production and directs them to the upper levels in the organizational hierarchy.

The organizational hierarchy of the J.P.M.C. includes eight administrative levels. Therefore, the organizational structure is highly centralised especially when the complexities of the tasks to be performed are considered.[1] The observed lack of delegation, even for routine matters, also indicates the highly centralised structure of authority. The company's instruction manuals specifying the rules and procedures for accomplishing each task, clearly indicate the presence of strict heirarchial control at three centres: The Board of Directors; the Director General; and the Mine Manager. Theoretical measures of the degree of centralisation include indicies such as the average span of control, the ratio of administrative to non-administrative personnel, the distribution of rewards in the organization and the location within the heirarchy of certain types of decision making.[2]

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1. For more details see, Edward Harvey "Technology and the Structure of Organization" American Sociological Review, 33(1968) p.250 and M.C. Barnes, A.H.Fogg, G.N.Stephens and L.G.Titman, Company Organization: Theory & Practice,(London:George Allen & Unwin Ltd.,1970)p.95-105.

2. For details about the degree and measurement of centralization see, T.C.Whilser,Measuring Centralization of Control in Business Organization: A new Perspective in Organizational Research,(New York: John Wiley & Sons, 1964), pp.305-320.

In order to give an insight into the organization of the J.P.M.C, administrative arrangements at the El-Hassa mine are discussed. [1]

El-Hassa mine is headed by a mine manager, normally an engineer who is responsible for the day to day activities of the mine. He has wide authority in managing the various departments and allocating personnel. The El-Hassa mine is functionally divided into nine departments each dealing with a different aspect of the mine's operations (Figure VII. b).

The Administrative Department deals with all routine administrative matters, and consists of nine offices employing 233 persons (See Figure VII.c)

The Mining Department, on the other hand, employs 303 persons and is responsible for production at El-Hassa from Orebodies (No.1,No.2,and N o.9) and an old concession area (See Figure VII. d.). Each orebody is mined by two shifts each headed by an engineer. This Department is the largest single unit at the mine.

The Handling and Processing Department deals with production activities, and consists of five sections employing a total of 258 (See Figure VII. e). The major sections are Beneficatiom and Drying, whereas the remaining three carry out only auxilliary activities.

Another department is the Laboratory and Quality Control Department, usually headed by a chemist, and responsible for testing the grade of phosphate rock after being dried, and recording the T.C.P and moisture contents of the finished products. This Department consists of two intermingled sections both employing 31 persons (See Figure VII. f).

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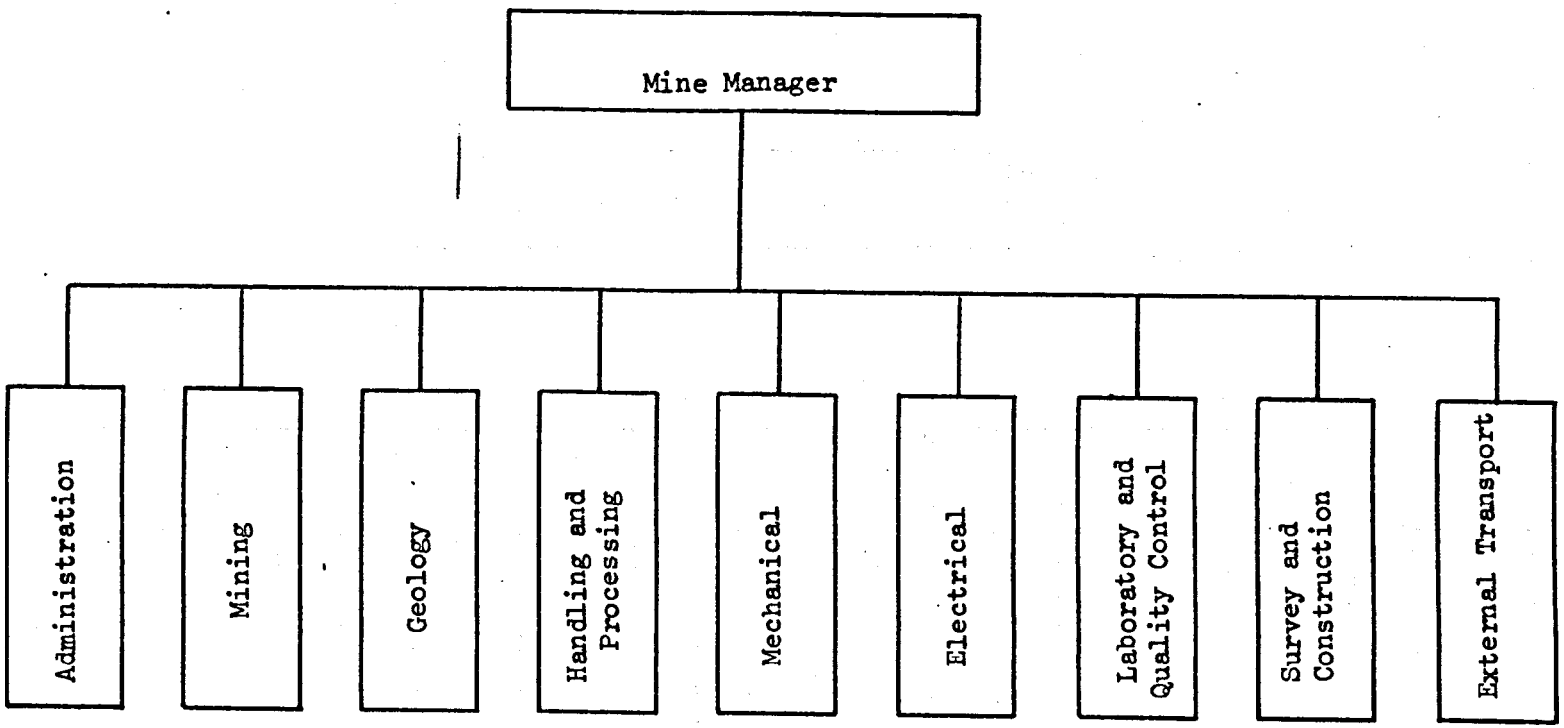
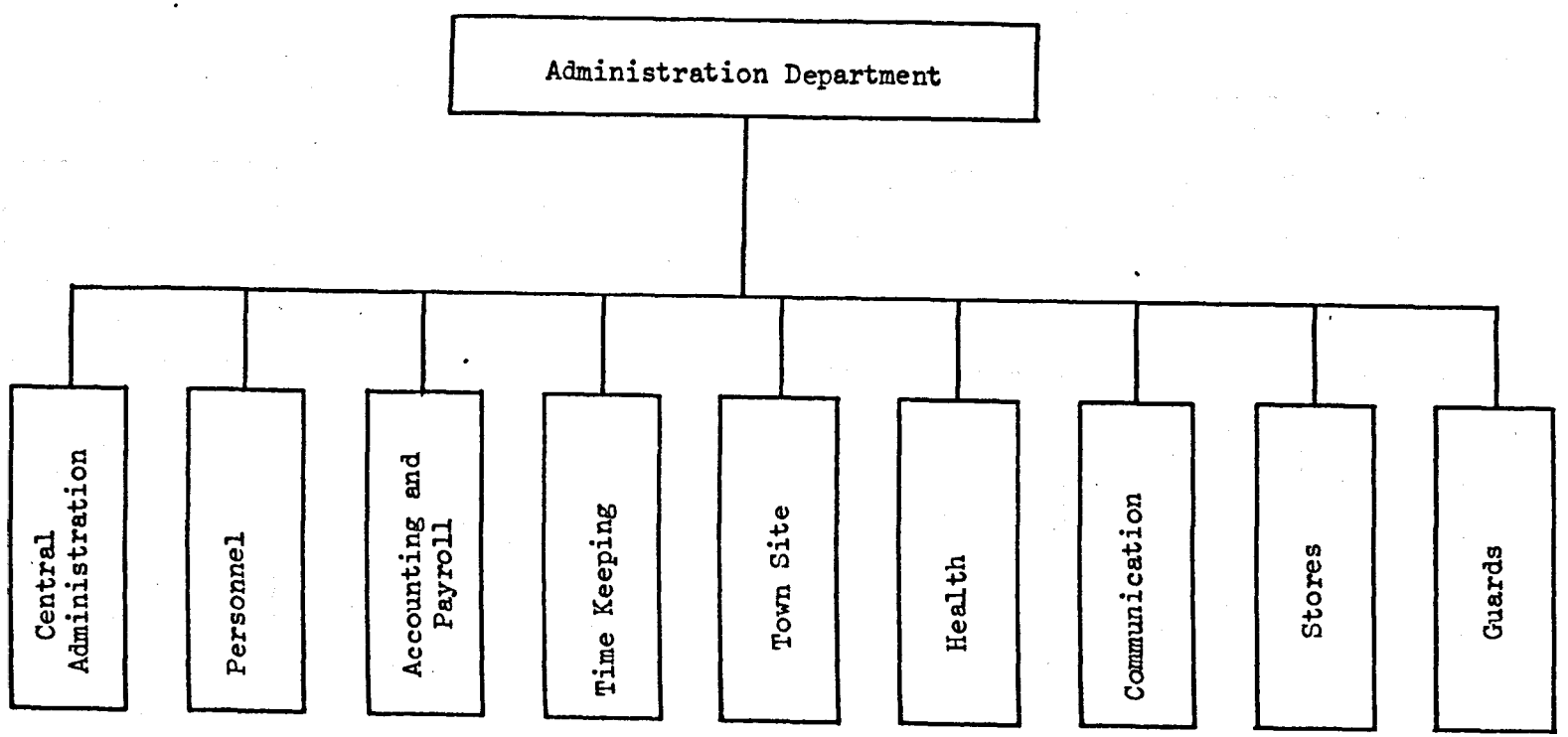
1. The administrative arrangements at Russeifa mine are similar to those at El-Hassa mine. To avoid repetition only arrangements at El-Hassa are discussed.

FIGURE VII,b. - THE ORGANIZATION CHART OF EL-HASSA MINE



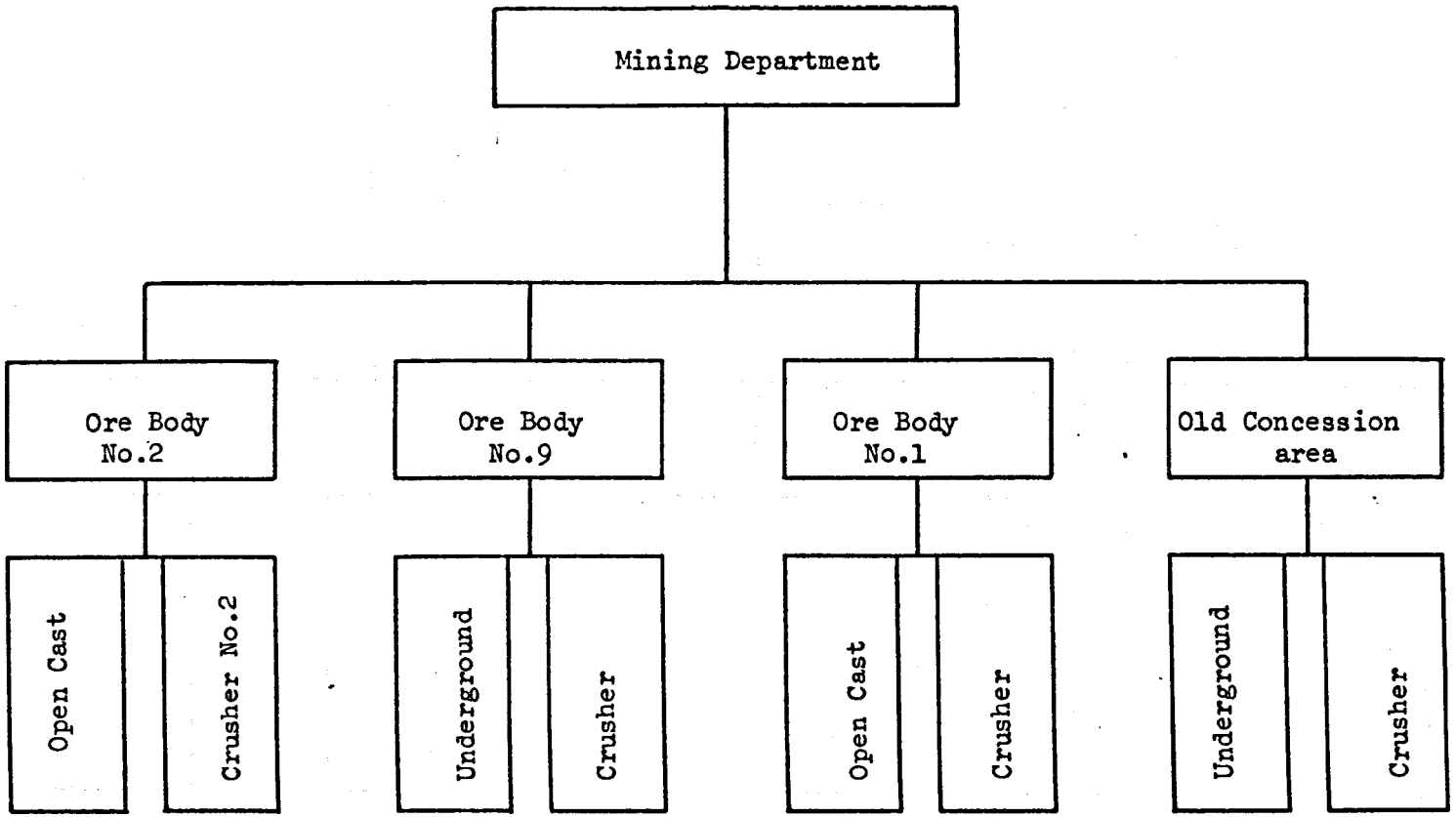
Source: Kingdom of Jordan, J.P.M.C.

FIGURE VII.c - THE ORGANIZATION CHART OF THE ADMINISTRATION DEPARTMENT OF EL-HASSA MINE



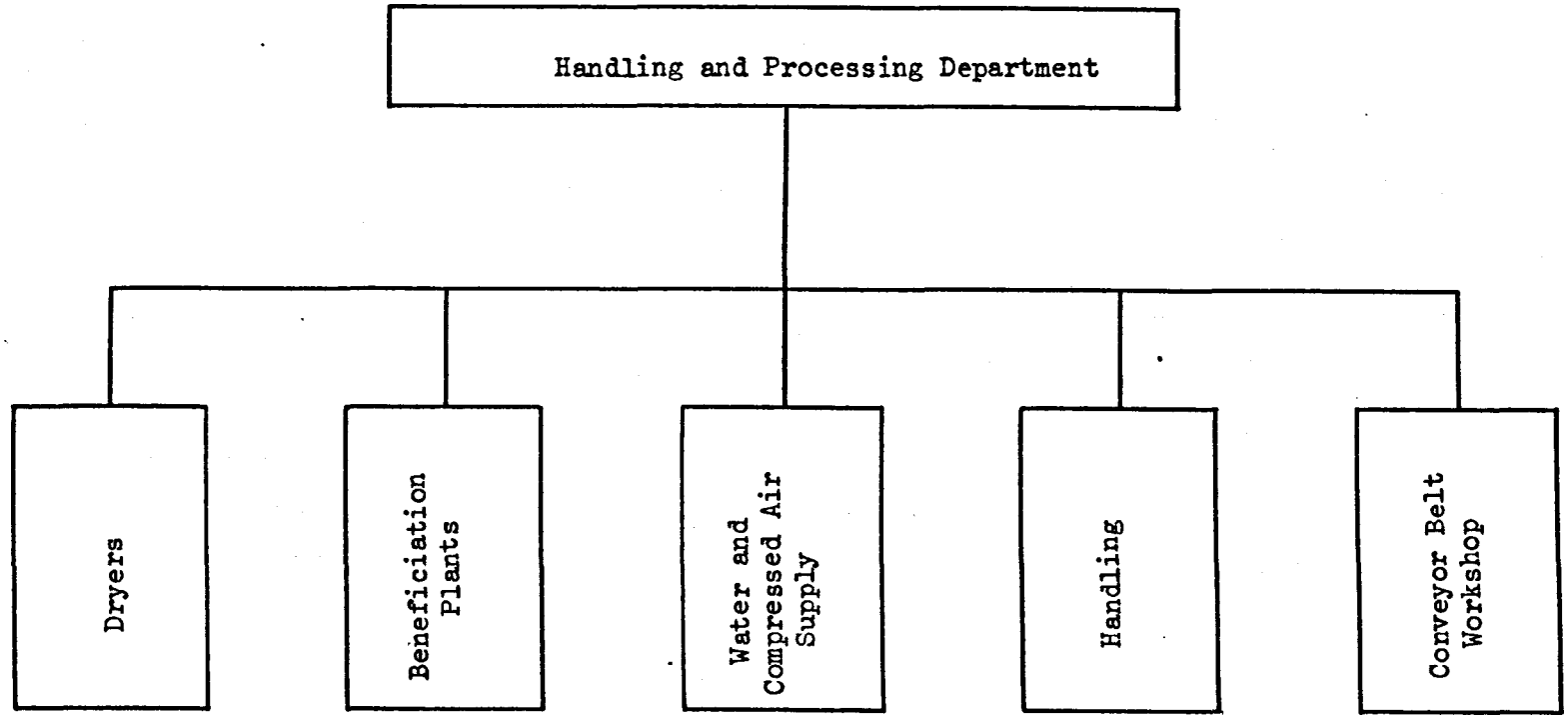
Source: Kingdom of Jordan, J.P.M.C.

FIGURE VII.d - THE ORGANIZATION CHART OF THE MINING DEPARTMENT OF EL-HASSA MINE.



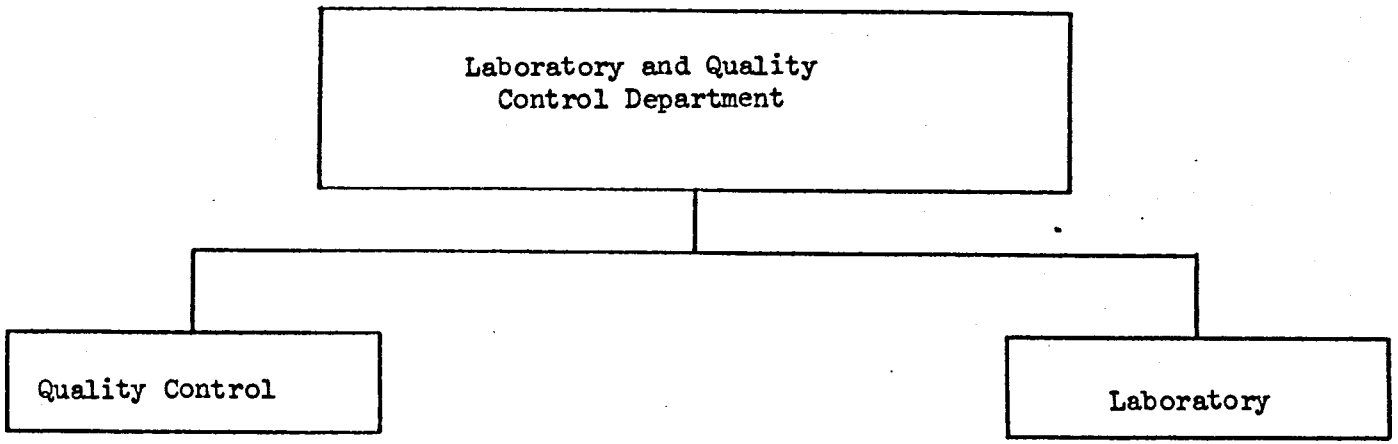
Source: Kingdom of Jordan, JPMC,

FIGURE VII.e - THE ORGANIZATION CHART OF THE HANDLING AND PROCESSING DEPARTMENT OF EL-HASSA MINE



Source: Kingdom of Jordan, JP.M.C.

FIGURE VII.f - THE ORGANIZATION CHART OF THE LABORATORY AND QUALITY CONTROL DEPARTMENT OF EL-HASSA MINE.



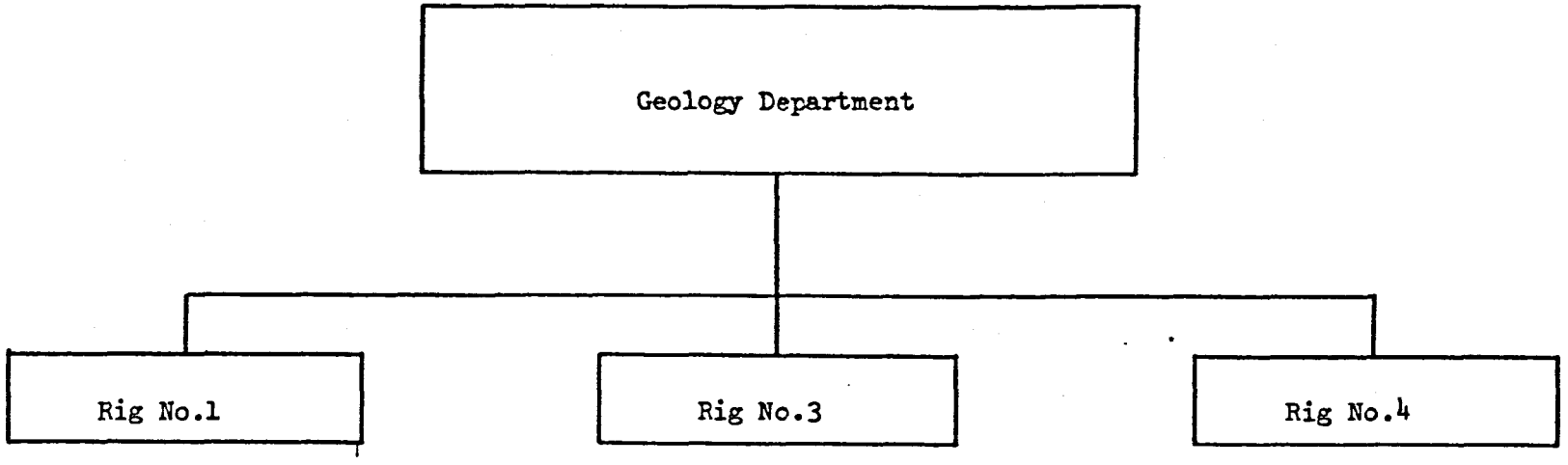
Source: Kingdom of Jordan, JPMC.

The fifth department, Geology, employs 18 persons divided into three groups, each consisting of a field geologist, driller, assistant driller, and two labourers. This Department is responsible for surveying the concession area and collecting samples to determine the measurement of phosphate rock beds, their T.C.P. content and other intervening soil layers (See Figure VII. g). The sixth department is the Survey and Construction Department. It consists of three sections employing a total of 45 people, involved in construction and maintenance of offices and other supporting buildings in the mine area (See Figure VII. h). The main construction projects, however, are normally sub-contracted to an outside firm. In these circumstances, this Department acts as a supervisor for the work done by other contractors.

At the same organizational level is the Electrical Department, consisting of five sections and employing a total of 41 technicians or electricians (See Figure VII. i). This Department is responsible for providing the mine and the townsite areas with electricity. Another department is The Mechanical Department, it employs 234 persons grouped into three divisions, with the Maintenance and Repair Division by far the biggest employing 147 persons (See Figure VII. j). Employees in this Department include, blacksmiths, operators, welders, carpenters and mechanists.

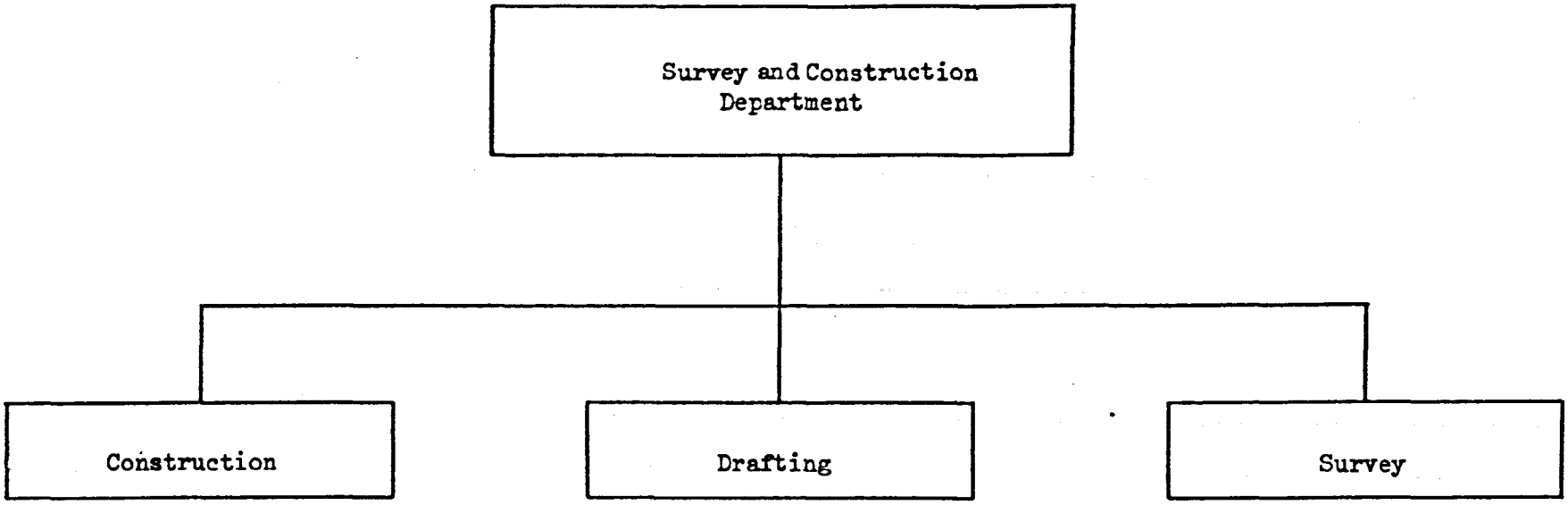
The ninth department, the External Export Department, consists of three sections and employs 24 persons. It is mainly responsible for loading the finished products onto trains and trucks, and keeping records regarding weight size, truck registry and driver's name (See Figure VII. k). The name of this Department is somewhat misleading since this Department is actually more of a dispatching unit than an External Transport Department.

FIGURE VII.g - THE ORGANIZATION CHART OF THE GEOLOGY DEPARTMENT OF EL-HASSA MINE



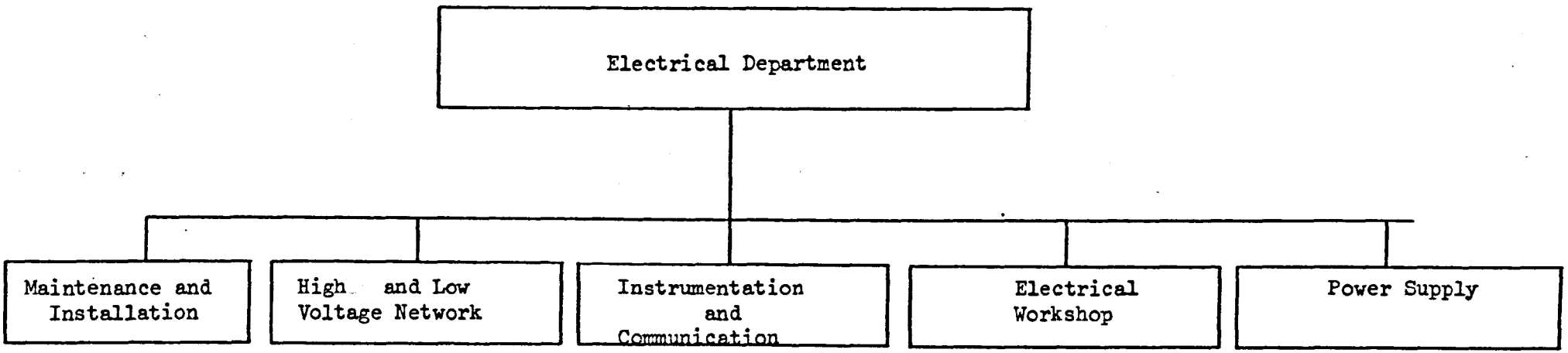
Source: Kingdom of Jordan, J.P.M.C.

FIGURE VII.h - THE ORGANIZATION CHART OF THE SURVEY AND CONSTRUCTION DEPARTMENT OF EL-HASSA MINE



Source: Kingdom of Jordan, J.P.M.C.

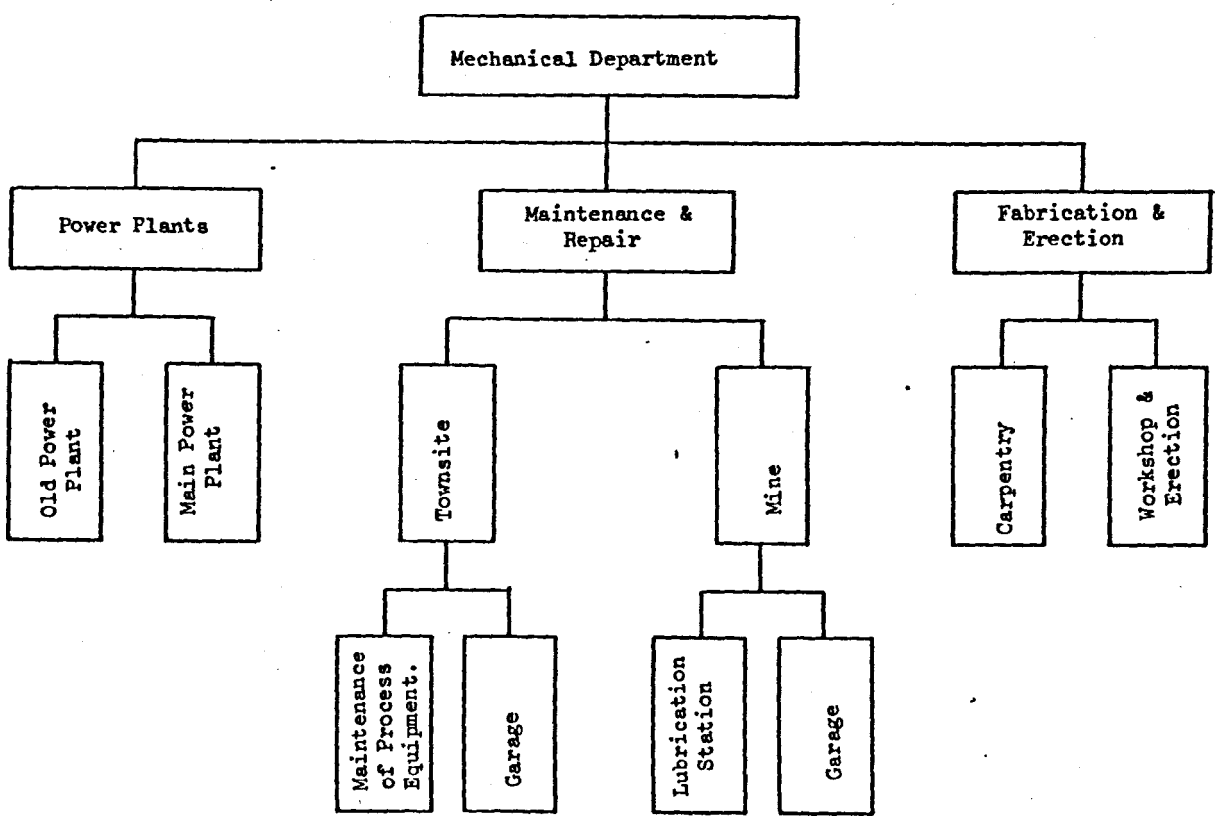
FIGURE VII.i - THE ORGANIZATION CHART OF THE ELECTRICAL DEPARTMENT OF EL-HASSA MINE



Source: Kingdom of Jordan, JP.M.C.

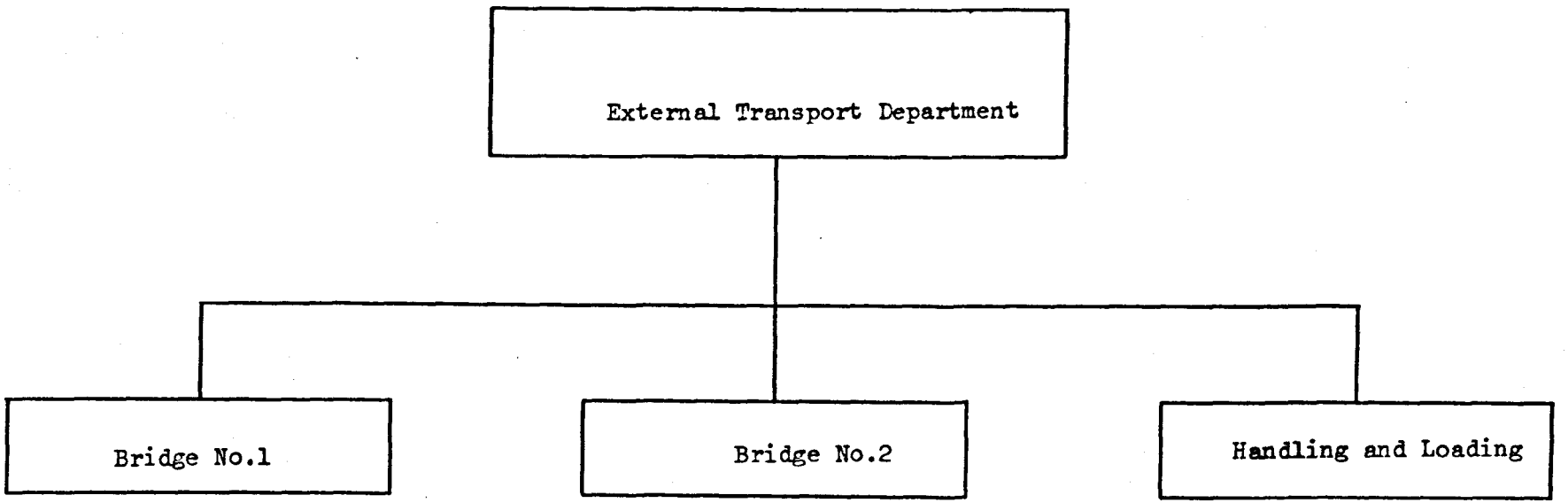
FIGURE VII.j

THE ORGANIZATIONAL CHART OF THE MECHANICAL DEPARTMENT OF EL-HASSA MINE



Source: Kingdom of Jordan, J.P.M.C.

FIGURE VII.k - THE ORGANIZATIONAL CHART OF THE EXTERNAL TRANSPORT DEPARTMENT OF EL-HASSA MINE



Source: Kingdom of Jordan, JPMC.

Other organizational units belonging to the J.P.M.C. are the offices at the exporting ports of Aqaba and Beirut. The office at Aqaba handles the bulk of phosphate rock exports and is responsible for the warehousing facilities which add up to about 200,000 tons of capacity. On the other hand, the Beirut office is responsible for confirming the arrival of shipments of phosphate rock at the Port of Beirut for loading on board freighters by the Lebanese Port Authorities.

PART TWO: ASPECTS RELATED TO THE J.P.M.C. LABOUR FORCE

A. SIZE AND LEVELS OF WAGES OF THE LABOUR FORCE AND BENEFITS ACCRUING TO J.P.M.C. EMPLOYEES

The labour force of J.P.M.C. is classified under three categories: salaried employees; wage earners; and those hired on a contract basis (See,Table VII.2). During the period 1960 to 1975 wage earners outnumbered salaried employees. Furthermore, their number grew at a much faster rate. This phenomenon, however, is expected since in any organization, the supporting structure composed of line officers, does not have to expand proportionately with the overall organizational growth.

Salaried employees are formally ranked according to a pay scale which does not apply to the wage earners whose allowances are fixed essentially by the mine managers (See,Table VII.3).

The labour force of the J.P.M.C. is entitled to different sorts of fringe benefits (See,Table VII.4). All kinds of benefits are received by professional employees whereas the rank and file employees receive only some of such benefits. Some of these fringe benefits are computed as a percentage of income, hence, favouring the higher income group. The fringe benefits offered by J.P.M.C. include health and insurance plans, savings plans, low rent housing facilities, a multi-purpose co-operative society, elementary school, sports facilities, and a public health clinic.

Health and insurance plans only cover those employees who join them. Other employees however, are compensated on a basis proportional to their incomes and ranging between 5 and 10 Jordan Dinars per month. The savings plan, on the other hand, covers all employees of the J.P.M.C., 10 per cent of an employee's income is withheld by the company and a comparable

TABLE VII. 2

J.P.M.C. EMPLOYMENT BY MAJOR CATEGORIES

FOR THE PERIOD 1960 to 1976.

YEAR	SALARIED EMPLOYEES	WAGE EARNERS	TOTAL
1960	90	1356	1446
1961	116	1528	1644
1962	118	1687	1805
1963	103	1090	1193
1964	112	686	798
1965	230	870	1100
1966	271	905	1176
1967	316	1120	1436
1968	334	1106	1440
1969	379	848	1227
1970	321	587	908
1971	311	685	996
1972	319	867	1186
1973	401	1095	1496
1974			1906
1975			2514
1976			2866

Source: Kingdom of Jordan, Jordan Phosphate Mines Company, Annual Reports, 1960-1976,(Amman).

TABLE VII. 3

SALARY SCALE FOR J.P.M.C. SALARIED EMPLOYEES.

RANK OR GRADE	SALARY MINIMUM J.D.	SALARY MAXIMUM J.D.	ANNUAL GROWTH J.D.	NUMBER OF YEARS IN RANK OR GRADE
Special	230	not specified	10.0	-
First	180	225	7.5	6
Second	145	181	6.0	6
Third	115	155	5.0	8
Fourth	94	130	4.5	8
Fifth	72	104	4.0	8
Sixth	56	80	3.0	8
Seventh	40	65	2.5	10
Eight	27	47	2.0	10
Ninth	17	32	1.5	10
Tenth	12	22	1.0	10

Source: Kingdom of Jordan, J.P.M.C., Modified Employment Manual of J.P.M.C., (Unpublished brochure), p. 13

TABLE VII. 4

COMPARATIVE DISTRIBUTION OF FRINGE BENEFITS TO CLASSES OF EMPLOYEES AT EL-HASSA MINE

FRINGE BENEFIT	PROFESSIONALS	RANK AND FILE
Health Care & Insurance	✓	✓
Savings Plan	✓	✓
Subsidized Co-operative	✓	✓
Free Transportation	✓	✓
Low Rent Housing	✓	✓
Retirement Plan	✓	—
Travel and Field	✓	—
Allowances	✓	—

Source: Kingdom of Jordan, J.P.M.C., Unpublished records of the Administrative Department of the J.P.M.C.

percentage contribution is made by the company. Again this clearly discriminates against the lower paid wage earners.

The low rent housing facilities are available only to the El-Hassa labour force. In 1975, there were about 1036 housing units in the mine site, 96, of which were assigned to married employees and the remaining units for the unmarried. By 1977, another 440 units had been completed. Alongside these facilities, a multi-purpose co-operative society, subsidized by the company, is available to offer services such as a food market, banking facilities, barber's shop etc. Furthermore, the company offers an elementary school, sports facilities and a public health clinic, with two resident physicians who occasionally give free medical treatment to patients from the surrounding community as a public relations gesture by the J.P.M.C.

The J.P.M.C. also has four categories of punishment, ranging from a warning, to laying off. The two categories in the middle include an unspecified deduction from the monthly pay and the withholding of the annual pay rise. [1]

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1. There are laws in Jordan which provide protection to any industrial worker who considers that he was subjected to unfair dismissal.

B. PRODUCTIVITY OF LABOUR

Productivity is a relation between output and a selected input, the input usually selected being labour.[1] Productivity is affected by every aspect of an industry. It depends on the levels of sales and exports, the size of the firms constituting the industry, the pay-scale, the quality of the labour force and management, and on many other aspects within the industry and its surrounding environment.

For measuring labour productivity, two methods are applied, the first, by taking the value added generated by the industry and dividing it by the number of employees, and the second, by taking the value added and dividing it by the total of wages and salaries. Table VII. 5 indicates that net output per employee for the J.P.M.C. grew from JD 1035.260 in 1965 to JD 1148.515 in 1966 and to JD 10115 by 1974.

The net output per JD of wages and salaries, however, grew from 3.632 in 1965 to 3.362 in 1966, and to 15.0 by 1974. Comparison of these productivity figures with those in other main industries in Jordan, shows that the net output per employee in the phosphate industry ranked fourth in 1965, third in 1966 and first in 1974; whereas net output per JD of wages and salaries for the J.P.M.C., ranked third in 1965 and 1966 and first in 1974.

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1. P.W. Gay and R.L. Smyth, The British Pottery Industry, (London: Butterworth and Company, 1974) p.229

TABLE VII. 5

LABOUR PRODUCTIVITY

INDUSTRY	1965		1966		1974	
	Net Output Per Labourer	Net Output Per JD of Wages and Salaries	Net Output Per Labourer	Net Output Per JD of Wages and Salaries	Net Output Per JD of Wages and Salaries	Net Output Per JD of Wages and Salaries
Phosphates	1035.260	3.632	1148.515	3.362	15.0	10115
Tobacco and Cigarettes	901.806	3.183	992.991	3.047	8.8	8208
Paper and Paper Products	306.513	2.857	314.763	2.825	2.3	1117
Petroleum Refining	2549.677	5.214	2831.135	4.855	8.3	7438
Cement	2684.314	7.243	2774.79	7.573	8.0	6417
Basic Metal Products	266.333	2.731	244.489	2.373	12.1	5738
Pharmaceuticals	1303.000	2.688	n.a.	n.a.	4.6	2681
Industrial Sector	437.106	3.079	463.457	3.093	n.a.	n.a.

Source: (i) See, Appendix VII. A.

(ii) For 1974, A.Alawin, The Structure and Performance of Manufacturing Industry in Jordan, (Ph.D. Thesis), Keele University, 1978.

PART THREE: AN EVALUATION OF THE PERFORMANCE OF THE J.P.M.C.

The analysis of market structure and behaviour of an industry provides observations upon which an evaluation of an enterprise's performance can be made. Earlier analysis revealed the monopolistic market structure of the Jordanian phosphate rock industry and the rigid pricing policies. However, these policies have undergone significant changes recently in response to fundamental alterations in the structure of the world phosphate rock markets.

The efficiency of an industry is usually measured in terms of common dimensions of enterprise performance such as output, income, profits, and cost structure. Another indicator, important in a resource-based industry, is the resource utilization and its outlook.

For the Jordanian phosphate rock industry, output, income, and cost dimensions have been analysed in other chapters. The output level of phosphate rock in Jordan grew at an annual average of approximately 8 per cent during the period 1962 to 1975, in response to world demand for phosphate rock which has increased at an annual average role of 5 per cent during the recent past.

The income from sales of Jordanian phosphate rock grew at an annual average of 18 per cent during the period 1962 to 1973, although the rate of growth averaged 109 per cent per year over the whole period, 1962 to 1975, because of the successive price rises in 1973 and 1974.

The analysis of the cost structure in chapter six indicated that total cost rose from JD 1.68 million in 1962 to JD 8.75 million in 1975. Comparing this rise to the rise of output during the same period reveals that the unit cost grew from JD 2.47 to JD 6.35, a rise of approximately 157 per cent. This increase in the unit cost, however, did not receive much attention from the higher management of J.P.M.C. particularly in

periods when phosphate rock selling prices increased substantially. With the decline of selling prices in 1975, the rise in the unit costs, if allowed to continue at the same rate, might seriously affect the profitability of the industry. Hence, the higher management of J.P.M.C. should attend carefully to their cost structure, since, by their nature, costs are not easily reversible.

In theory, competitive performance requires that an industry passes on reductions in costs to buyers in the form of reductions in selling prices. Hence, selling prices would be closely related to the level of the long run average cost. Previous chapters have demonstrated the oligopolistic market structure of the world phosphate rock industry and the position of the Jordanian industry as a mere price follower. Thus, the selling prices of phosphate rock in the world markets have reflected the market power of the world phosphate rock industry and therefore, have yielded above normal profits.

Another useful tool for evaluating the performance of an industry is to analyse the level of long-run profits. When an industry realises above normal profits or rates of return during periods of rapidly growing world demand, these profits will in time be bid down through the injection of new capital into the industry, the expansion in output, and the reduction in selling prices.[1] The traditional theory of the firm emphasises the importance of the profit aspect for evaluation.[2]

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1. J.E.Hazelton, the Economics of the Sulphur Industry, (Washington D.C. the John Hopkins Press, 1970), p. 112

2. For details see, W.H. Flarbuck, Organizational Growth & Development (London: Hazell Watson and Viney Ltd, 1965), pp.13-25, M.C.Barns, A.H.Fogg, C.N.Stepens, and L.G.Titman, Company Organization: Theory and Practice, (London: George Allen & Unwin Ltd, 1970),pp.67-70

However, the assumptions of this theory have been severely attacked on the grounds that a firm may choose to maximize other than profits and may operate at different levels of certainty. [1] The closing of the Suez Canal in 1967 and the Syrian-Jordanian border in 1970/1971, and the decision of the Indian Government to boycott imports of Jordanian phosphate rock in 1969/1970 because of political differences about the dispute between India and Pakistan, all took the higher management of J.P.M.C. by surprise, and eventually had a great effect on the level of sales of Jordanian phosphate rock in export markets.

As an approximate measure, an average annual rate of return for J.P.M.C. is computed for the period 1962 to 1975, to evaluate the industry's performance, and hence its profitability. The average of the annual rates computed stood at 3.925. Such an average is low, although it is not uncommon among extractive industries. Nevertheless, this average has ranged from a high of 10.9 in 1965 to a low of -4.699 in 1970 as indicated in Table VII. 6. The negative rates of return of 1970 and 1971 were caused by the drastic decline in exports of Jordanian phosphate rock to India, the main export market. These losses, however, were subsidized by the Jordanian Government, without which the reported net profit of 1972 (JD 73,337) would have been a loss in the order of JD 121,663 and therefore, the average rate of return for that year would have automatically been negative. In practice, such governmental subsidies are not unusual, because a government must take necessary measures to prevent imperative costly exit situation under such circumstances. [2]

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1. Michael Coizier, the Bureaucratic Phenomenon, (Chicago: the University of Chicago Press, 1964), p.179.

2. Albert Hirchman, Exit, Voice and Loyalty Responses to Decline in Firms, Organizations, and States, (Boston: Hayvard University Press, 1970), p.74.

TABLE VII.6.

JPMC'S PROFITS, TOTAL ASSETS AND RATES OF RETURN DURING THE PERIOD 1960-1975.

(Amounts in Jordanian Dinars)

YEAR	NET PROFITS	DISTRIBUTED PROFITS	TOTAL ASSETS	OPTIONAL RESERVES	RATE OF RETURN	UNDISTRIBUTED PROFITS
1962	106181	-	2345728	-	4.527	-
1963	80929	-	2821915	-	2,868	-
1964	123843	132393	2611619	-	4.742	-
1965	295132	295132	2708125	-	10.900	-
1966	380189	284836	3587916	-	10.596	95553
1967	169892	240000	6293072	-	2.700	25428
1968	290437	307023	7456063	8843	3.895	-
1969	74309	-	7233631	-	1.027	83903
1970	-328206	-	7029808	-	- 4.699	-
1971	-219669	-	7523897	-	- 3.983	-
1972	73337	73336	8072734	-	0.908	-
1973	111377	111376	8647125	-	1.288	-
1974	1504927	1504926	16380640	1042753	9.187	-
1975	921190	-	26736793	-	3.445	-
(1962-1975)					3.925	

Source: Kingdom of Jordan, JPMC, Annual Reports, 1962-1975,(Amman).

Between 1973 and 1975 the J.P.M.C. was able to make windfall profits due to the substantial successive increases in the world selling prices of phosphate rock. In these circumstances the Jordanian Government levied excise taxes of JD. 6.910 million in 1974 and JD. 11.024 million in 1975. Had it not been for these taxes, the overall profitability picture of the J.P.M.C. would have looked far brighter. At this stage, it is important to point out the limitations that exist as a result of using accounting data for obtaining the average rates of return on invested capital. Accounting concepts used in calculating corporate profits differ significantly from the use of the corresponding economic concepts appropriate to the measurement of income.[1] Similarly, the use of total assets to represent invested capital probably does not reflect the actual value of the firm's investments in plant and equipment. Moreover, the mining fees payable to the government are considered to be the costs of doing business. Hence, income and consequently net profits are reduced. While these limitations are important and must be recognized, the case for using accounting data for computing the rates of return of invested capital must rest on practical grounds of data availability.

Finally, answers to such questions as: How effective has the J.P.M.C been in utilizing the phosphate resource? Has the mining been efficient? Has there been adequate investment in the discovery and development of new reserves? Have consumers been assured of adequate supplies of phosphate rock?, give another way for evaluating the performance of the J.P.M.C. [2]

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1. For a detailed analysis on economic and accounting concepts for calculating profits see, Edgar O.Edwards, and Philip W.Bell, The Theory and Measurement of Business Income ,(Berkeley: University of California Press, 1961)

2. See, Edward S.Mason, The Political Economy of Resource Use, In Perspective on Conservation of Resources for Future ,(Baltimore: The John Hopkins Press Inc.,1958) ,pp.154-186.

It is evident that the J.P.M.C. has been efficient in exploiting the phosphate resource. However, its activities were interrupted in 1967, 1970, and 1971 because of the 1967 June War and its consequences, as well as, the boycott by India and the People's Republic of China of Jordanian phosphates. As for resource development, it is usually the case that it occurs in response to needs transmitted through the market mechanism by either changes in conditions of supply or in conditions of demand. Increases in supply occur in response to prices yielding above normal profits and usually lead to new entries to the industry, and new developments to exploit sources of supply that were not previously competitive. On the other hand, decreases in supply usually occur as a result of closing down marginal mines in response to prices yielding below normal profits. Changes in the conditions of demand for a resource usually occur in response to changes in relative factor costs.

The phosphate rock industry in Jordan is provided with adequate funds for investment in the discovery and development of the phosphate resource in relation to the net income of the industry as shown at an earlier stage of the study. The Jordanian Government has always given a high priority to projects related to the development of this industry as evident in its economic and social development plans. This is because of the favourable position of phosphate rock in world markets, particularly in recent years. The Five-Year Plan for Economic Development, 1962-1967, allocated 2.85 million Jordan Dinars or 2.2 per cent of total investment during the currency of the Plan to mining, most of which was used in the phosphate rock industry.[1]

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1. Kingdom of Jordan, The Jordan Development Board, The Five-Year Plan for Economic Development, 1962-1967, (Amman: 1962), Table 23.1

The Three-Year Plan for Economic and Social Development, 1973-1975 however, called for a total investment of JD 4.85 million in the phosphate rock industry or 2.7 per cent of total investments in the Plan.[1] Furthermore, the Five-Year Plan for Economic Development,1976-1980, aims at increasing the productive capacity of the J.P.M.C. to no less than 7 million tons by 1980. This most recent Plan calls for an investment of JD 24 million or 3.1 per cent of the total investment during the currency of the Plan.[2] The main development projects which are either already under-way, or still being investigated for economic feasibility are discussed in chapter six. Such projects aim at increasing the level of output and hence exports, in order to capture a bigger share of the international markets for phosphate rock. This should help stabilise the Jordanian economy and provide considerable amount of foreign exchange earnings to finance imports.

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1. Kingdom of Jordan, The National Planning Council, The Three-Year Plan For Economic and Social Development, 1973-1975,(Amman: 1973),pp.132-134.

2. Kingdom of Jordan, The Five-Year Plan for Economic and Social Development, 1976-1980, (Amman: 1976),p.64

PART FOUR. SUMMARY AND CONCLUSION.

(i) The organizational structure of the J.P.M.C. includes four functional departments the duties of which are highly centralised in the office of the Director General. Furthermore, the organization of the J.P.M.C. consists of eight administrative levels and the structure of authority is highly centralized even even for routine matters.

(ii) It is evident that the J.P.M.C. lacks high calibre staff in all its departments. This has led to inefficiency in the day-to-day running of the company, although the company realised substantial profits during 1973 and 1974. These were mainly due to the substantial increases in the selling prices of phosphate rock in world markets in those years. Furthermore, the policy of the Government to subsidise the company's losses, and the successive changes of top personnel in recent years, have had a bad effect on the overall efficiency of J.P.M.C.

(iii) The lack of a pay scale for wage earners has caused unrest among this group since their pay is usually decided arbitrarly by mine managers on grounds other than efficiency and ability.

(iv) The monetary and non-monetary benefits accruing to the labour force compare favourably with those offered by other industrial and Governmental establishments in the country.

(v) Labour productivity, measured as net output per employee or per JD of wages and salaries has increased during the period 1965 to 1974. It compares favourably with that in other main industries in the country. In fact, in 1974 the labour productivity of J.P.M.C. was highest than any other industrial establishment. Undoubtedly, improvements in the fields of production, organization, and marketing in the company, will lead to further improvements in productivity.

CHAPTER EIGHT: MARKETING ASPECTS OF THE JORDANIAN PHOSPHATE ROCK INDUSTRY

While the previous three chapters analysed the Jordanian economy, the organizational and production aspects of the Jordanian phosphate rock industry, this chapter reviews the marketing aspects of this industry.

PART ONE. MARKETING ORGANIZATION.

Marketing activities of J.P.M.C. include: selling phosphate rock; purchasing phosphate supplies and ensuring their availability; storing and releasing these supplies; planning the transportation of phosphate sales to exporting ports; handling of phosphate rock at ports; loading of phosphates on board ships; and recently, arranging for ocean transport when sales are made on C.I.F. basis. The sales and marketing manager of the J.P.M.C. is in charge of all marketing activities. He is assisted by a few sales and shipping clerks.

Frequently, sales to foreign countries are made through one or more of the following channels:

a. Agreements concluded through direct private contacts between J.P.M.C. and foreign industrial firms. This is generally done through reciprocated visits of the officials of J.P.M.C. and the foreign firms.

b. Bilateral or trilateral agreements concluded between the Jordanian Government and foreign governments. Such transactions may be carried out according to barter deals, such as those between the Jordanian Government and the governments of Yugoslavia and India. Alternatively, they may be carried out according to confirmed and irrevocable letters of credit.

c. Agreements concluded through a third party, such as agents. This channel has been an important one in effecting sales of phosphate rock to foreign customers. The J.P.M.C. has a number of agents spread over the Jordanian phosphate rock export markets. These include: Messrs. Soconomar S.P.A in Italy (Milano); Mitsubushi Corporation in Japan (Tokyo); E.I.D. Parry in India (Madras); Crockston and Company in Gt. Britain (London); Roberts and Company in Ceylon; and Federal Fertilizer Company S.D.N. in Malysia (Kualalumpur).[1] The sole agents of J.P.M.C. are granted a commission of two per cent in all cases.[2] This remuneration, however, is not satisfactory when compared with the higher commissions paid for other phosphate rock agents by other phosphate rock exporting countries. In general, it pays off when there is a close co-operation between the producer and his agents.[3] He should exert some control over his agents and send his representatives on regular visits. The agents, on the other hand, are expected to send regular reports to the producer concerning sales, prices, forecasts of demand, and the activities of competitors. Agents, usually, tend to resent too much control.

The agents of J.P.M.C. in export markets are not considered to be of a particularly high calibre. Furthermore, representation is not wide enough and agents are not well supported and controlled by J.P.M.C.

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1. Kingdom of Jordan, J.P.M.C. interview with the Sales and Marketing Manager, August 1976.
2. Ibid., Interview.
3. Robert Douglas Stuart, Penetrating the International Market,(New York: American Management Association Inc., 1965). pp.88-90.

It has been noted that no regular reports are received from agents and therefore, the management of J.P.M.C. is not provided with the market intelligence needed for wider operations and better decision making.

To promote sales, J.P.M.C. uses advertising, but on a very limited scale.[1] J.P.M.C. takes part in international fairs, places advertisements in magazines with particular interest in phosphate rock, such as the Mining Annual Review, and in local magazines in some export markets.

J.P.M.C, in its marketing activities, faces serious problems. These problems are related to:

(1) The concentration of world demand for phosphate rock on the product containing 74 per cent T.C.P. This problem makes it very difficult for Jordan to sell its products of less than 74 per cent T.C.P content. Hence, Jordan has to beneficate its phosphate rock products to satisfy the needs of the phosphate rock importers.

(2) The political problems resulting in the closure of the Suez Canal in 1967, the closure of the Syrian/Jordanian Borders in 1970/1971, and the internal civil disturbances of 1970. These problems and their consequences considerably affected the production levels and the sales of phosphate rock to foreign countries.

(3) Transport problems, mainly related to the limited capacities of the Ports of Beirut and Aqaba. These problems have also affected the sales volume of Jordanian phosphate rock.

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1. For details on advertising see, Douglas W. Smallbone. An Introduction to Marketing (London: Staples Press, 1968), p.11.

(4) Some importers such as Yugoslavia tend not to depend on one source of imports.

(5) The high percentages of impurities, such as flourine and chlorine, and moisture which characterize the Jordanian phosphate rock. These problems require the J.P.M.C. to reduce such percentages to the levels acceptable in world markets.

(6) Finally, the lack of a strong marketing team at the J.P.M.C. and the efficient agents in importing countries exert more pressure and hence reduce sales. The company, therefore, has to provide internal courses to provide more qualified personnel and also some employees have to be trained abroad to improve their marketing expertise. The J.P.M.C must also employ high calibre agents to improve its representations in foreign markets.

If these problems are solved, J.P.M.C. should stand an excellent chance in international markets.

PART TWO: PRICING POLICIES, PRACTICES, AND TRENDS

The J.P.M.C. applies the same criteria for deciding phosphate rock pricing policies and practices as discussed in Chapter Four.
In quoting its prices, Jordan usually follows the Moroccans when selling grade products 70/72 and 73/74 per cent T.C.P. to markets in Eastern Europe, while it follows Florida list prices when sellings its products of grades 76/77 and 80/82 per cent T.C.P. to markets in Japan and Australia.[1] In practice, however, it is noted that Jordan has quoted higher prices than Morocco and Florida although the quality of its rock is sometimes inferior to those of Morocco and Florida. During the period 1961 to 1963 Florida phosphate rock of grade 73 per cent T.C.P. was quoted at $8.45 per ton whereas the same grade product was quoted at $10.50 per ton by Jordan.[2] On the other hand, the Moroccan grade product 76 per cent T.C.P. was quoted at $10.76 per ton, the same price as is quoted by Jordan for the 72 per cent T.C.P. grade.[3]

Phosphate rock prices of J.P.M.C. are frequently quoted on F.O.B. basis via the Ports of Aqaba and Beirut. This attitude by J.P.M.C. caused some rigidity in its sales policies and occasionally led to the loss of some contracts. During the second half of 1975 when the world demand for phosphate rock decreased, the J.P.M.C. could no longer afford applying rigid policies and therefore, was forced to adjust its policies to allow for sales of rock on C.I.F. basis.

During the period 1956 to 1972 the prices of Jordanian phosphate rock were relatively stable. However, by mid 1973 and throughout 1974 world phosphate prices rose substantially due to the increase in world

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1. Ibid., Interview.
2. Ibid., Interview.
3. Ibid., Interview.

demand for phosphate rock. The export selling prices of Jordan in 1974 ranged between U.S. $54.0 and U.S. $64.0 per ton, thus averaging U.S. $40.03 per ton.[1] The selling prices of the first six months of 1975 are, however, are shown in (Table VIII.2).

The relative stability in the Jordanian phosphate rock export prices, however, are partially explained by the fact that the bulk of its exports were regulated by bilateral trade agreements which made the price issue a secondary one in negotiations to sign contracts.

According to forecasts made by J.P.M.C, selling prices for Jordanian phosphate rock are expected to decrease.[2] In calculating these figures, J.P.M.C. assumed an inflation rate of 12 per cent for 1975, 10 per cent for 1976, 8 per cent for 1977, and 6 per cent for years afterwards.[3]

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1. See, Table VIII.1
2. Interview with.Sales & Marketing Manager,op.cit.
   See, Table VIII.3.
3. Kingdom of Jordan, J.P.M.C, Interview op.cit.

TABLE VIII.I.

PRICE MOVEMENTS OF THE JORDANIAN PHOSPHATE ROCK, 1956-1974

YEAR	PRICE IN JDS PER TON	PRICE IN U.S. $ PER TON	EXCHANGE RATE JD/U.S. $
1956	4.128	11.56	2.80
1957	4.289	12.01	2.80
1958	4.210	11.79	2.80
1959	3.941	11.03	2.80
1960	3.886	10.88	2.80
1961	3.790	10.61	2.80
1962	3.749	10.50	2.80
1963	3.872	10.84	2.80
1964	3.807	10.66	2.80
1965	4.000	11.20	2.80
1966	4.259	11.93	2.80
1967	4.217	11.81	2.80
1968	4.290	12.01	2.80
1969	4.222	11.82	2.80
1970	4.255	11.91	2.80
1971	4.133	11.57	2.80
1972	4.062	11.37	2.80
1973	4.319	12.96	3.00
1974	12.829	40.03	3.12

Source: Kingdom of Jordan, JPMC, Sales and Marketing Department.

TABLE VIII.2.

AVERAGE SELLING PRICES FOR JORDANIAN PHOSPHATE ROCK DURING THE FIRST HALF OF 1975. ($/TON)

MONTH	BY SEA AQABA	BY SEA BEIRUT	BY LAND TO BEIRUT AND TURKEY
January	58.98	57.64	54.23
February	61.35	60.02	54.17
March	63.28	61.43	54.23
April	64.42	61.44	57.38
May	63.57	61.51	55.16
June	53.81	61.38	49.21

Source: Kingdom of Jordan, JPMC, The Sales and Marketing Department.

TABLE VIII.3.

FUTURE EXPECTED PRICES OF JORDANIAN PHOSPHATE ROCK, 1976-1980

YEAR	PESSIMISTIC FORECAST		OPTIMISTIC FORECAST	
	CONSTANT (1974)	CURRENT	CONSTANT 1974	CURRENT
1976	20.12	24.79	25.0	30.80
1977	20.12	26.25	25.0	33.26
1978	20.12	27.83	25.0	35.26
1979	20.12	29.50	25.0	37.38
1980	20.12	31.27	25.0	39.62

Source: Kingdom of Jordan, JPMC, The Sales and Marketing Department.

PART THREE: TRANSPORTATION OF JORDANIAN PHOSPHATE ROCK.

This section deals with the means of transport utilized by the Jordanian phosphate rock industry, the costs of transport, problems associated with transportation, and the prospects of improved transport services in Jordan to aid the development programmes of J.P.M.C.

A. LAND TRANSPORT

The phosphate rock industry in Jordan utilizes both land and sea means of transport. The land means of transport include railway wagons, and highway trucks. The highway network available for Jordan imports and exports consists of a system of primary, secondary and local roads. The primary network totals 1490 kilometres of two-lane road and 45 kilometres of dual carriage-way road excluding roads in cities. The secondary network, totals 723 kilometres of two-way road.[1] Statistics indicate that there are some 1800 trucks available throughout Jordan for general long-distance haulage, excluding private trucks used exclusively by companies, tipper trucks used in the construction industry and vehicles of less than 10 tons payload.[2] Table VII.4 shows that in 1974 about 70 per cent of the commercial vehicles were pickups and small trucks. Another 10 per cent were external operators which are only permitted to engage in haulage outside Jordan.

For the haulage of phosphate rock from the Russeifa mines to Aqaba and the return carriage of imports from Aqaba to Amman, a syndicate was formed, and was granted a monopoly for this trade.

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1. Kingdom of Jordan, National Planning Council, Imports and Exports: Transport Study, (Amman: 1970) p.20.
2. Ibid., p.p. 30-41.

TABLE VII$_T$.4

FLEET COMPOSITION OF VEHICLES AVAILABLE FOR GENERAL HAULAGE IN 1974.

TYPE	LOAD (TONS)	NUMBER	PERCENT
Rigid	12-14	919	52
Truck Trailer	24-28	280	16
Semi Trailer	26-30	269	15
Refrigerated	16-18	127	7
External Operators	24-30	188	10
Total		1783	100

Source: Garages' Union, Amman, 1976)

It supplys menas of transport to the phosphate mines on demand and also arranges with freight forwarders at Aqaba for the transport of imports to destinations in the country. The haulage of phosphate rock from Russeifa towards the north is contracted exclusively to one company, although this company usually subcontracts to other private operators, being unable to satisfy the mine's transport requirements. The haulage of rock towards Iskanderun, in Turkey, is shared with Syrian contractors.

The main rail network available in Jordan is the one built in the early 1900's. It was constructed to link Beirut-Damascus-Deráa (on the Syrian-Jordanian borders), Amman-Maán (in the South of Jordan), and Medina in Saudi-Arabia. However, following the First World War the line South of Maán was abandoned due to the considerable damage caused by the War to the railway installations. Other railways were constructed to link with the main railway as will be shown later in the chapter.

The means of transportation available for hauling Jordanian phosphates to ports of export are highway trucks and railway wagons. Exports of Jordanian phosphates were largely routed through the Port of Beirut until the commissioning of 'Berth B' at Aqaba in 1959 which allowed increased usage of Jordan's only port.

The majority of phosphate rock produced in Russeifa goes north by both rail and road for export through the Port of Beirut and for use in the Lebanese Fertilizer Plant at Silatah and the southern Turkish Fertilizer Plant at Iskanderun. However, the amount of rock hauled by rail is limited. The significance of the Port of Beirut to the Jordanian phosphate rock trade was emphasized when the Suez Canal was closed in 1967 and the Jordanian-Syrian Borders were closed in 1970/1971.

Part of the phosphate rock produced in Russeifa, however, is transported south by trucks for export through the Port of Aqaba. Furthermore, exports of phosphate rock from El-Hassa are all hauled by trucks and railway wagons to the Port of Aqaba.

Tables VIII.5 and VIII.6 indicate the relative importance of each means of transport in the Jordanian phosphate rock trade. The ratio of quantities of phosphate rock transported by trucks to Aqaba to all quantities transported by trucks averaged 64.3 per cent during the period 1964 to 1974, whereas that of quantities of rock transported by trucks to Beirut averaged 35.7 per cent. Therefore, the transportation of phosphate rock by trucks to Aqaba was relatively more important than to Beirut. On the other hand, Table VIII.6 reveals that the ratio of quantities of phosphate rock transported to Aqaba by rail to all quantities of rock transported by rail averaged 18.3 per cent, whereas the ratio of quantities of rock transported by rail to Beirut to all quantities of rock transported by this means of transport averaged 81.7 per cent. Such ratios clearly indicate that the usage of this means of transport to Beirut was relatively more important than to Aqaba.

However, the ratio of quantities of phosphate rock transported by trucks to both ports Aqaba and Beirut to all quantities transported over the period 1964-1974 averaged 89.2 per cent indicating the high relative importance of the usage of trucks in phosphate rock transport.[1] The ratio of quantities of rock transpported by rail, on the other hand, averaged only 10.8 per cent.

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1. See, Table VIII.7.

TABLE VIII.5

QUANTITIES OF PHOSPHATE ROCK TRANSPORTED BY TRUCKS TO THE PORTS OF BEIRUT AND AQABA AND THEIR RELATIVE IMPORTANCE, 1964-1974 (in tons and percentages)

YEAR	1 TO AQABA	2 TO BEIRUT	3 TOTAL	RATIO OF 1 TO 3	RATIO OF 2 TO 3
1964	456900	68435	525335	86.9	13.1
1965	51469	48670	100139	51.4	48.6
1966	640671	43908	684579	93.5	6.5
1967	614210	187384	801594	76.6	23.4
1968	632196	488041	1120237	56.4	43.6
1969	530077	423911	953988	55.5	44.5
1970	88536	449971	538507	16.4	83.6
1971	343041	290813	633854	54.1	45.9
1972	673767	262510	936277	71.9	28.1
1973	766838	356095	1122943	68.2	31.8
1974	1090754	347491	1437945	75.8	24.5
Average (1964-1974)				64.3	35.7

Source: Kingdom of Jordan, JPMC, Annual Reports, 1964-1974 (Amman).

TABLE VIII.6

QUANTITIES OF PHOSPHATE ROCK TRANSPORTED BY RAIL TO THE PORT OF BEIRUT AND AQABA AND THEIR RELATIVE IMPORTANCE,(1964-1974)

(in tons and percentages)

YEAR	1 TO AQABA	2 TO BEIRUT	3 TOTAL	RATIO OF 1 TO 3	RATIO OF 2 TO 3
1964	37605	70409	108014	34.8	65.2
1965	51469	60402	111871	46.0	54.0
1966	27674	65130	92804	29.8	70.2
1967	15344	69290	84634	18.1	80.9
1968	2271	64574	66845	3.4	96.6
1969	-	48052	48052	-	100.0
1970	-	29347	29347	-	100.0
1971	-	19486	19486	-	100.0
1972	15370	24163	39433	38.9	61.1
1973	9446	22073	31519	29.9	70.1
1974	-	25692	25692	-	100.0
Average 1964-1974				18.3	81.7

Source: Kingdom of Jordan, JPMC, Annual Reports, 1964-1974, (Amman).

TABLE VIII.7.

THE RELATIVE IMPORTANCE OF QUANTITIES OF PHOSPHATE ROCK TRANSPORTED IN EACH RAIL AND TRUCKS, 1964-1974

(in tons and percentages)

YEAR	BY TRUCKS	BY RAIL WAGON	TOTAL	RATIO OF 1/3	RATIO OF 2/3
1964	525335	108014	633349	82.9	17.1
1965	100139	117871	212010	47.2	52.8
1966	684579	92804	777383	88.0	12.0
1967	801594	84634	886228	90.4	9.6
1968	1120237	66845	1187082	94.3	5.7
1969	953988	48052	1002040	95.2	4.8
1970	538507	29347	567854	94.8	5.2
1971	633854	19486	653340	97.0	3.0
1972	936277	39433	970710	95.9	4.1
1973	1122943	31519	1154462	97.2	6.8
1974	1437945	25692	1463637	98.2	1.8
Average (1964-1974)				89.2	10.8

Source: Kingdom of Jordan, JPMC, Annual Reports, 1964-1974, (Amman).

The distribution of phosphate rock sales from Jordan according to means of transport indicates that in 1974 the majority of transport was undertaken by road.[1]

1. See, Table VIII.8

TABLE VIII.8

PRODUCTION AREA AND DESTINATION

OF PHOSPHATE ROCK, IN 1974

AREA/DESTINATION	MILLION TONS
Russeifa	
Exports to Beirut Port	
By Rail	0.026
By Road	0.213
Exports to Lebanese Fertilizer Plant by Road.	0.133
Exports to Turkey	
By Road	0.022
Exports to Aqaba	
By Road	0.222
Sub-total (Russeifa)	0.616
El-Hassa	
Exports to Aqaba	
By Road	0.866
Total Sales*	1.482

(*) total exports were 1.469 million tons, the 13,000 tons balance being accounted for by stocks at Aqaba and sales not delivered.

Source: Kingdom of Jordan, JPMC, The Sales and Marketing Department.

A.1. LAND TRANSPORT COSTS.

Costs of land transport in Jordan affect the choice of means of transport to be utilized. However, they have no effect on the selling prices of the Jordanian phosphate rock, since prices are decided upon among the members of the International Super Phosphate Manufacturers Association (I.S.M.A.)

Table VIII.9 shows that land transport cost by rail was becoming cheaper than that by road. It is, however, cheaper to use the company's own trucks to transport the phosphate rock from Russeifa to Beirut than using commercial trucks (Table VIII.10). However, the same cost is paid when transporting to Aqaba.

A.2. PROBLEMS FACING LAND TRANSPORTATION.

The Jordan phosphate rock industry has suffered since its inception, from land transportation problems. Such problems include: the distance of ports of export from phosphate rock production areas and the passage through two neighbouring countries in transporting Jordanian phosphate rock to Syria and Lebanon; the limited capacity of both highway and railway transportation; and finally, the limited storage capacity at ports of export. Such problems caused transport costs to rise above those of production and mining. In 1952, for example, the F.O.B. price for Jordanian phosphate rock was $12.26 per ton, of which $2.80 represented production and mining costs and the remaining $9.46 represented transport costs.

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1. Kingdom of Jordan, J.P.M.C., Accounts Department.

TABLE VIII.9.

TRANSPORT COSTS OF JORDANIAN PHOSPHATE ROCK FROM PRODUCTION AREAS TO PORTS OF EXPORT
(in JDS/ton)

	1960	1965	1970	1975
Cost of Transport by Trucks				
Russeifa - Aqaba	1.190	1.000	1.200	1.600
Russeifa - Beirut	1.015	1.400	1.520	2.335
El-Hassa - Aqaba	-	-	0.800	1.400
Cost of Transport by Railcars				
Russeifa - Ras El Naqab	1.000	0.545	0.545	0.545
Ras El Naqab - Aqaba (trucks)	0.400	0.325	0.400	0.550
Russeifa - Beirut	1.825	1.500	1.500	1.500
El-Hassa - Aqaba	-	-	-	1.300

Source: Kingdom of Jordan, JPMC, The Sales and Marketing Department.

TABLE VIII.10

COSTS OF LAND TRANSPORT

(in JDS/ton)

DIRECTION	MEANS OF TRANSPORT	TO BEIRUT	TO AQABA
Russeifa	Commercial trucks	1.970 on first 15000 tons 3.65 on next 10000 tons	1.60
	Company's trucks	2.100 on first 3000 tons 2.85 over the 3000 tons	1.60
	rail wagons	1.59	-
Hassa	Commercial trucks	-	1.40
	Company's trucks	-	1.40

Source: Kingdom of Jordan, JPMC, The Sales and Marketing Department.

All exporting ports used by J.P.M.C. are well over 200 kms. from the production areas. The Russeifa mines lie 210 kms. from the Port of Beirut and about 300 kms. from the Port of Aqaba, while the El-Hassa mines are about 220 kms. far from the Port of Aqaba. Comparing these distances with those of the exporting ports of Florida and Morocco, it is found that most of Florida phosphate rock deposits lie within a radius of about 70 kms from the Port of Tampa, whereas the Port of Safi of Morocco is about 70 kms. away from Moroccan phosphate rock deposits and the Port of Casablanca is only about 125 kms. distance.

Furthermore, the passage of transported phosphate rock through Syria, Lebanon, and Turkey, sometimes, poses serious threat to the exports of phosphate rock. An example of this occured in 1970/1971 when Syria closed its borders with Jordan, and since 1975 when civil war broke out in the Lebanon. Other serious sub-problems arise from the transport policies and currency and custom regulations practised in those countries.

The limited capacity of highway and railway facilities imposes another problem. The length of the highways in Jordan, excluding those lying inside cities and villages, is 3800 kms.[1] By 1974 the number of highway trucks operating on highways stood at 3490.[2] The number of trucks used for external transportation, however, stood at 323.[3] The capacity of the highway linking production areas of phosphate rock with the Port of Aqaba stands at 2 million tons per year, whereas J.P.M.C aims at producing 6 million tons by 1980.

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1. Kingdom of Jordan, Ministry of Industry and Trade.
2. Ibid.,
3. These trucks include those which have Syrian or other licences.

On the other hand, the railway network consists of:[1]

a. The railway that links Nasib at the Jordanian-Syrian borders with Maan, a length of 324 kms. It passes through Mafraq, Zerqa, Russiefa, Qatraneh,and El-Hassa. It links Jordan with Syria, Lebanon, and Turkey. This railway was constructed in the early 1900's.

b. The railway that extends from Maán to Ras-El Naqab with a length of 40 kms. This railway was constructed during the second World War.

c. The railway that links Maan with Mudawarah on the Jordanian-Saudi borders. This is 113 kms. long.

d. In 1975, a new railway, 116 kms. long, operated between Hitiah and Aqaba, with an extension of 7 kms. to El-Hassa. This railway has a capacity of 2 million tons per year with plans to increase it to 6.5 million tons by 1980.

To remedy this situation the Jordan Government, in its Five Year Development Plan for 1976/1980 adopted the following projects:[2]

a. The Maán-Mafraq-Rum highway project: This project, which needs JD. 4.5 million to construct, aims at absorbing the increasing density of traffic due to developments in important export activities. This highway is expected to start operating in mid-1978 with a length of 74 kms.

b. Utum/Aqaba highway project: This project aims at transporting the phosphate rock raw material to the chemical plant in Aqaba for the production of fertilizers. This project needs an investment of 2.5 million Jordan Dinars. The distance of this highway will be 30 kilometres.

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1. Kingdom of Jordan, Aqaba Railway Corporation.

2. Kingdom of Jordan, the National Planning Council,Five-Year Development Plan, 1976-1980, (Amman:1976),pp 392-416.

This highway is expected to be completed in 1979.

c. The project to increase the transportation capacity for phosphate rock. This project, as the name suggests, aims at gradually increasing the transportation capacity of the railway from El-Hassa to Aqaba, from 4.5 million tons in 1977 to 6.5 million tons by 1980. This requires an investment of 14 million Jordan Dinars and it is expected to materialize by 1979.

The third problem relates to the limited storage and handling capacities at both Ports, Aqaba and Beirut.

Aqaba, Jordan's only port, had no deep water berths until the end of 1959, when 'Berth A' came into operation and Cargo Berth No.1 came into use. The facilities available by then included transit sheds, open storage areas, power station and ancillary buildings, and phosphate rock stores Nos. 1 and 2. The increase in the general cargo traffic, however, necessitated an extention to the port. By 1965, Cargo Berth No.2 was completed with transit shed, open and covered storage areas. By 1969, bulk export Berth 'B' and phosphate rock stores Nos.3 and 4 were completed.

Berth 'A' was designed to load 20,000 D.W.T. ships and is equipped with a fixed position shiploader with a capcity of 500 tons per hour.[1] Phosphate stores Nos. 1 and 2 are each of 20,000 tons capacity and are connected by belt conveyors from the intakes for receiving phosphate rock from road vehicles and to the shiploader. Berth 'B', on the other hand was designed for loading ships of up to 100,000 D.W.T, and is equipped with one travelling shiploader with a capacity of 1500 tons per hour.

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1. Kingdom of Jordan, interviews with a number of personnel working at the Port of Aqaba, August 1976.

Behind this Berth, the two phosphate rock stores Nos.3 and 4 were constructed with a storage capacity of 72,000 tons each. Each store is fed by belt conveyor from a road intake hopper, and reclamation from the stores for shiploading is, as with stores Nos. 1 and 2, by hopper openings in the store floors leading through adjustable gates to reclaim conveyors. The transit shed in the Cargo Berth No. 1 and No.2 provide about 10,800 square metres of covered storage area. There are also, about 55,000 square metres of storage area within the cargo port area, excluding the wide roadways between the storage areas and the wide areas between the transit sheds which are used when there is congestion.

With the development of phosphate rock exports through the Port of Aqaba, the Jordan Government, in its Five-Year Development Plan for 1976 to 1980, decided to expand the phosphate rock storage and shipping facilities at the Port. The Port of Aqaba Project, included in the Plan, aims at constructing two new stores with a storage capacity of 115,000 tons of phosphate rock each, installing new shiploading equipment with a capacity of 2,100 tons per hour, and increasing the capacity of the available shiploader to 2,100 tons per hour. These developments require an invested capital of JD 10 million. The project also aims at constructing a third Berth 'C' with storage capacity of 115,000 tons and a loading capacity of 100 tons per hour, a further investment of JD 8 million. This project is scheduled to be completed in 1979.

Jordanian phosphate rock is handled in the Port of Beirut through a berth which has an adjacent storage area. The handling methods which include crane, clamshell, and boxes are considered to be inefficient.

The amounts of phosphate rock handled through the Port of Beirut, in recent years have generally been between 150,000 and 250,000 tons with a maximum level of 360,000 tons in 1968/69.[1]

Increases in the traffic of Jordanian phosphate rock through Beirut seem unlikely to happen since any expansion can only be possible if the berth is expanded, which in this case, would be at the expense of one of the neighbouring general cargo berths. Beirut's Port authorities are not prepared to consider such a solution unless Jordan is prepared to contribute to the required capital, give assurances that definite quantities of phosphate rock would be routed through Beirut in the future, and accept new charges established to cover current costs.[2] However, Jordan is not likely to commit itself to such conditions due to the important improvements at Aqaba Port and the re-opening of the Suez Canal.

The major short-term problem at the Port of Beirut seems to be the lack of co-ordination between the Port authorities and J.P.M.C. concerning notification about the flow of trucks carrying phosphate rock from Russeifa and their expected times of arrival at the Port. It is believed that the level of 1968/69 of phosphate rock handled at the Port could easily be achieved if these matters were co-ordinated with the arrival of cargo vessels.

The Lebanese Fertilizer Plant which requires about 500,000 tons of phosphate rock per year is unlikely to depend completely on Jordanian phosphate rock due to the past experience of border closures between Syria and Jordan.

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1. Kingdom of Jordan, J.P.M.C. interview with the Sales and Marketing Manager, April 1977.
2. Kingdom of Jordan, J.P.M.C. interview with the Director General, April 1977.

Another problem related to the transport of Jordanian phosphate rock to Turkey is the quota that is imposed by Syria on the Jordanian trucking to Turkey. A proportion of Jordan's supply must be carried in Syrian trucks. The lack of enough trucking capacity in Syria makes it necessary for some supplies to be transported by sea.[1] Therefore, for Jordan to be able to meet its agreed tonnage to the Turkish Fertilizer Plant it has to secure ways for sea transport. After long negotiations with the Syrian Government, it has been agreed that Jordan can use the Port of Tartus in Syria for exports.

B. SEA TRANSPORT

Jordanian phosphate rock is usually transported in bulk either as full shiploads or, sometimes, as part-cargo. Bagged shipments of phosphate rock are also practised but in very rare cases. An example on such shipments is the exportation of Jorphos to Ceylon.

In most cases the responsibility for shipping arrangements lies in the hands of importers of Jordanian phosphate rock since most sales are made on a F.O.B. basis. Recently, sales on C.I.F. basis have been made. Hence, responsibility for shipping arrangements in these cases lies in the hands of J.P.M.C. However, the choice of ships to be used in transporting the phosphate rock is restricted by the limited availability of ships in the Red Sea and nearby areas. Shipping from Aqaba is secured in one of two ways[2]: Firstly, by ships operating within the conference system which are regularly trading in the Red Sea or Gulf area and secondly, those ships which may be loosely described as "tramps" which, having voyaged into the area, are in a position to load a full cargo of phosphate rock.

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1. Kingdom of Jordan, J.P.M.C., interview with the Sales and Marketing Manager, April 1977.
2. Ibid.,

Appendix VIII.A indicates the sizes and distribution of ships which transported the Jordanian phosphate rock in 1966 and 1971. In neither years were ships of over 20,000 D.W.T. employed to carry phosphate rock. Throughout the period 1971 to 1974, the ships loading at Aqaba were predominantly small, tweendeck cargo liners and tramps. The majority of such ships were originally built for conventional "break-bulk" liner services. They are generally ten years old and some actually date back to World War II. The largest ship transporting phosphate rock from Aqaba during 1971 to 1974 was of 23,000 tons, and the most widely used type of ship was the 10,000 to 12,000 D.W.T. tramp built in the early 1960's. Of the 124 ships which loaded phosphate rock at Aqaba in 1974, only 22 could be considered as modern, being less than ten years old (Appendix VIII.B). Moreover, 25 per cent of the ships were built by Indian flag shipping, reflecting the importance of the Aqaba-India trade in phosphate rock.

The limited use of modern bulk carriers is partially explained by the conditions governing the supply of shipping within the Red Sea and the adjoining areas. Owners of the larger, single-deck bulk carriers, consider the Red Sea and the adjoining areas to be a back-water because with the exception of grain, only lesser cargo is presently being shipped in bulk to the Near East.[1] Moreover, the conditions of ports in the area are not favourable to bulk carriers. However, the use of larger ships might be encouraged by the growing and substantial shipments of cement to the Arabian Gulf.[2]

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1. H.P.Drewery,op.cit., p.78.
2. Ibid., p.78

Therefore, at present, the shipping trade within the Red Sea and adjacent areas, consists of cargo liners and tramps in the 5,000/15,000 D.W.T. size range, and hence, charterers have little choice in the size of ship to be employed in transporting the phosphate rock from Aqaba. However, with the increasing traffic into the Arabian Gulf, it may become possible to increase the size of individual shiploads of phosphate rock. Appendix VIII. C, indicates that 83 per cent of the ships finding employment at Aqaba for transporting phosphate rock, were directed to Aqaba after unloading their cargos within the Red Sea and Gulf of Aden areas.

Ocean transport to India, an important market for Jordanian phosphate rock, was examined to show the size and type of ship employed to transport phosphate rock to an importing country. Table VIII.11 clearly indicates that in 1971, India received 36 per cent of its phosphate rock imports in ships of less than 10,000 D.W.T, 30 per cent in ships of 10,000 to 20,000 D.W.T.,and 34 per cent in ships of over 20,000 D.W.T. This indicates that bulk carriers were responsible for shipping about one third of India's imports of phosphate rock in 1971.

Jordan's main sea transportation problem regarding its phosphate rock stems from the present shipping and chartering practices of buyers of Jordanian phosphate rock and especially their employment of small, multi-deck ships. Such practices hampered the J.P.M.C. from operating their loading installations at anything near their capacity. Therefore, additional shiploading facilities would enable J.P.M.C. to handle the envisaged throughput and therefore, circumvent the problem. However, the overall solution to the problem will only be achieved when the buyers of Jordanian phosphate rock are persuaded to change their shipping practices and introduce larger, more efficient ships into their trade with Jordan.

TABLE VIII.II.

SIZES OF SHIP TRANSPORTING PHOSPHATE ROCK TO INDIA IN 1971 (% OF IMPORTS)

SIZE GROUP	UNDER 10000 DWT	10/20000 DWT	20/30000 DWT	OVER 30000 DWT
Exporter:				
Jordan	68	32	-	-
Morocco	85	15	-	-
Tunisia	25	75	-	-
Senegal	-	100	-	-
U.S.	-	11	24	55
Total Imported	37	30	12	21

Source: International Superphosphate Manufacturers' Association (ISMA)

With respect to the freight rates from Aqaba to destinations in the Mediterranean area and in South East Asia, Table VIII.12 indicates that they grew substantially over the period 1960 to 1975, from about $4.5 per ton in 1960 to about $10.5 per ton in 1975 for the Mediterranean area, and from about $7 per ton in 1960 to $12.5 per ton in 1975 for South East Asia.

By mid-1972, spot ocean freight for Jordan phosphate rock fell to under $5.0 per cargo ton, but by mid-1974, these rates had risen to $20 per cargo ton, comparing favourably with those of Morocco and Florida which stood at $45 and $30 per cargo ton respectively.[1] These differentials are explained by differences in cargo sizes, charter terms, canal dues, and shipping distances.

As far as port charges levied by port authorities or those providing services within ports are concerned, these differ significantly from port to port. Port charges at Aqaba for example, appear to compare favourably with those of other principal phosphate rock loading ports and seem to be well below those at Casablanca.

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1. H.P.Drewery, op.cit., p.53.

TABLE VIII.12.

EVOLUTION OF FREIGHT RATES
FOR JORDANIAN PHOSPHATE ROCK FROM
AQABA TO MEDITERRANEAN AREA
AND SOUTH EAST ASIA
(U.S. $ per Cargo ton)

YEAR	MEDITERRANEAN AREA RANGE OF RATE($)	SOUTH EAST ASIA RANGE OF RATE($)
1960	4 - 5	6 - 8
1965	5 - 9	7 -10
1970	9 -12	6 - 9
1975	10 -11	10 -15

Source: Kingdom of Jordan, JPMC, the Sales and Marketing Department.

B.1 DEVELOPMENTS OF PHOSPHATE ROCK SHIPPING THROUGH THE PORT OF AQABA

The volume of imports through the Port of Aqaba rose rapidly between 1964 and 1966, as shown in Table VIII.13. However, they fell considerably in 1967 and 1968 due to the closing of the Suez Canal and the 1967 June War. The volume of imports through Aqaba increased in 1969, but fell in 1970 because of the civil disturbances. The closing of the Syrian borders in 1971 and 1972 led to a rapid increase in the import volumes through Aqaba. However, a fall in the import volumes occured as a result of the re-opening of the Syrian borders and the 1973 October War.

Prior to 1960, Jordan phosphate rock was exported through the Port of Beirut. Since 1960, the Port of Aqaba has been used for phosphate rock exports and the quantities dispatched through the Port of Beirut have not exceeded 500,000 tons of rock per year, as indicated in Table VIII.14. Exports of phosphate rock through the Port of Aqaba increased from about 629,000 tons in 1966 to over a million tons in 1974.[1] Exports of phosphate rock, by volume, through Aqaba accounted for almost 90 per cent of Jordan's total exports through the Port of Aqaba during the period 1966 to 1970.[2] Volumes of exports of phosphate rock were affected by the closing of the Suez Canal in 1967 and the civil disturbances of 1970, however, substantial increases occured, resulting from the closing of the Syrian Borders in 1971 and 1972. In recent years, about two-thirds of the tonnage of rock shipped through the Port of Aqaba has been destined for markets in the Indian Ocean, whilst the remaining one-third has gone to markets in the Far East (Table IV. 15). In 1971, about 80 per cent

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1. Kingdom of Jordan, J.P.M.C, Annual Reports 1966 and 1974,(Amman)
2. Kingdom of Jordan, J.P.M.C, Annual Reports,1966-1974,(Amman)

TABLE VIII.13

PORT OF AQABA: TRAFFIC SUMMARY, 1964-1974

(in 000s tons)

YEAR	IMPORTS	EXPORTS	TOTAL	NUMBER OF SHIPS
1964	340.3	480.8	821.1	542
1965	408.2	509.0	917.2	579
1966	590.3	657.1	1247.5	666
1967	353.8	650.9	1004.7	452
1968	161.4	694.7	856.2	275
1969	205.0	538.5	743.5	269
1970	195.6	186.2	381.9	220
1971	278.1	387.1	665.2	254
1972	518.6	704.8	1223.6	327
1973	433.8	811.3	1245.0	304
1974	367.4	1116.0	1483.6	299

Source: Kingdom of Jordan, Aqaba Port Department.

TABLE VIII.14.

PHOSPHATE ROCK SHIPMENTS THROUGH THE PORTS OF AQABA AND BEIRUT, LEBANON BY JORDAN PHOSPHATE MINES COMPANY.

(Tons, Products)

	1969	1970	1971	1972	1973	1974
SHIPMENTS VIA AQABA						
to: Iran	-	-	-	-	75,060	13,650
Pakistan	-	29,254	-	20,460	22,000	43,200
India	367,597	62,520	249,253	391,985	343,537	548,919
SRI Lanka	1,829	2,215	8,398	3,300	5,900	2,500
Bangladesh	7,400	-	-	-	-	-
Malaysia	-	-	-	-	4,000	16,800
Cambodia	-	-	-	-	-	2,500
China	67,020	58,700	-	-	-	-
S Korea	-	-	-	-	10,500	10,100
Japan	8,695	4,862	48,455	179,596	194,807	258,379
Taiwan	13,200	10,000	19,700	48,400	81,110	98,250
Tanzania	-	-	-	36,200	30,100	80,186
Total Via Aqaba	465,741	167,551	325,906	679,941	767,014	1,074,484
SHIPMENTS VIA BEIRUT						
to: Turkey	77,505	100,690	55,980	80,630	120,929	123,241
Bulgaria	-	-	-	-	-	10,150
Rumania	-	6,100	10,250	-	-	-
Yugoslavia	249,430	192,770	126,555	49,850	38,150	83,785
Czechoslovakia	42,635	47,930	30,755	51,550	41,450	49,250
Total Via Beirut	369,570	347,490	223,540	182,030	200,529	266,426
Total Offshore Shipments:	835,311	515,041	549,446	861,971	967,543	1,340,910
Overland to Syria and the Lebanon	92,985	143,015	101,487	90,400	121,975	127,966

Source: Kingdom of Jordan, JPMC, Sales and Marketing Department.

TABLE VIII.15

PHOSPHATE ROCK SHIPMENTS VIA THE PORT OF AQABA TO INDIAN OCEAN AND FAR EASTERN MARKETS, 1969-1974.

	1969	1970	1971	1972	1973	1974
	(000 Tons, Product)					
Indian Ocean	376.8	94.0	257.7	451.9	476.6	688.0
%	81	56	79	66	62	64
Far East	88.9	73.6	68.2	228.0	290.4	386.0
%	19	44	21	34	38	36
Total Shipped	465.7	167.6	325.9	679.9	767.0	1,074.0
	(Million Ton/Miles)					
Indian Ocean	1,180	280	801	1,387	1,472	2,182
%	70	34	61	45	41	44
Far East	643	531	504	1,709	2,136	2,733
%	30	66	39	55	59	56
Total Ton/Miles	1,823	811	1,305	3,096	3,608	4,915
	(Average Nautical Miles)					
Indian Ocean	3,130	2,980	3,110	3,070	3,090	3,170
Far East	7,220	7,215	7,390	7,495	7,355	7,080
All Routes	3,915	4,840	4,005	4,555	4,705	4,575

Source: H.P. Drewery, Phosphate Rock Shipping Through Port of Aqaba, Jordan, (London: 1975.

of rock shipments through Aqaba were despatched to fairly near markets.[1]

B.2 THE IMPLICATIONS FOR JORDANIAN PHOSPHATE ROCK SHIPPING OF THE RE-OPENING OF THE SUEZ CANAL.

The closing of the Suez Canal indeed affected Jordan's access to East European markets. Without Suez, the quantity of phosphate rock that Jordan can sell in Eastern Europe is likely to be very limited, particularly, with the physical constraints on the shipping capacities through the Ports of Beirut and Tartus. Therefore, the closing of the Canal caused the J.P.M.C. to defer plans for rapid expansion. The re-opening of the Suez Canal has affected and benefited Jordan in two ways. Firstly, it has reduced the shipping distances and consequently, the unit transportation costs between Aqaba and destinations in the Mediterranean and Black Sea areas, which made it possible for Jordan to compete at equal terms with other major suppliers such as Morocco. Secondly, it increased the number of ships available to transport the Jordanian Phosphate rock from Aqaba, since the Red Sea area would no longer be considered a back-water due to the reductions in time and transport costs on a variety of routes from North Atlantic and Mediterranean areas to ports East of Suez.

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1. Kingdom of Jordan, J.P.M.C, interview with Sales and Marketing Manager, April 1977.

PART FOUR: EXPORTS OF JORDANIAN PHOSPHATE ROCK.

A. CURRENT EXPORTS.

The importance of the phosphate industry in Jordan stems from the fact that phosphate rock is the most essential export commodity in the country. In 1975, phosphate rock sales were about 1.112 million tons, worth some JD 21.2 million, thus, constituting about 34 per cent of total domestic exports which amounted to JD 48.0 million (Table VIII.16). Jordanian sales of phosphate rock are generally contracted on F.O.B. basis.[1] However, some quantities are delivered ex-mine to customers in Lebanon and Turkey.

It is apparent from Table VIII.17 that exports have increased from 0.058 million tons in 1954 to 1.7 million tons in 1976 or an increase of about 420.2 per cent. However, the average annual rate of growth in exports during the period 1954 to 1976 was 19.1 per cent.

The decline in exports of about 6 per cent during the period 1962 to 1963 was partly due to the decline in exports to Yugoslavia which could not finance its imports from Jordan with hard currency and therefore reduced such imports. India also was not able to import Jordanian phosphate in March/April of 1963 due to delays by the Indian authorities in issuing import permits for importing Jordanian phosphates. Sales in 1964 were 70 per cent higher than the 1963 level and reached 0.627 million tons. Jordan, in that year, was able to penetrate new markets for the first time, such as those in Italy and Bulgaria. The slowing down in production from the El-Hassa mines in 1965 led to a slight decline in exports of 3 per cent. During the period 1965 to 1968, exports grew

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1. In 1975, the J.P.M.C. was forced to sell on C.I.F. basis because of the tough competition in world markets.

TABLE VIII.16

SALES OF JORDANIAN PHOSPHATE ROCK DURING THE PERIOD 1954 TO 1976

YEAR	SALES IN TONS	SALES IN JD (F.O.B.)	PERCENTAGE CHANGE
1954	57513	252197	-
1955	150621	646758	+ 161.9
1956	157009	648144	+ 4.2
1957	213695	916479	+ 36.1
1958	241280	1015541	+ 12.9
1959	266234	1049366	+ 10.3
1960	329006	1267044	+ 23.6
1961	394336	1484819	+ 19.9
1962	371640	1393200	- 5.8
1963	368504	1426786	- 1.0
1964	627074	2387694	+ 70.2
1965	604648	2418829	- 3.6
1966	754736	3214518	+ 24.80
1967	881658	3718416	+ 16.80
1968	1095227	4698985	+ 24.20
1969	928296	3919510	- 15.3
1970	658056	2799968	- 29.1
1971	650833	2689923	- 1.1
1972	952371	3868253	+ 46.3
1973	1089518	4706357	+ 14.40
1974	1468894	20432831	+ 34.8
1975	1111877	21182033	- 24.3
1976	1653142	20649000	+ 48.7
Average Annual ratio of Growth 420.2/22 = 19.1 percent			

Source: Kingdom of Jordan, JPMC, Statistics Division.

TABLE VIII.17

RELATIVE IMPORTANCE OF PHOSPHATE ROCK EXPORTS TO TOTAL DOMESTIC EXPORTS 1943-1976

(In Million Jordanian Dinars)

TIME	EXPORTS OF PHOSPHATE ROCK (1)	DOMESTIC EXPORTS (2)	RATIO OF 1:2
1943	0.017	2.34	0.7
1952	0.030	2.11	1.4
1953	0.050	2.66	1.9
1954	0.050	3.05	1.6
1955	0.600	3.54	17.0
1956	0.690	5.11	13.5
1957	0.920	5.48	17.0
1958	0.98	3.43	28.6
1959	1.02	3.35	30.4
1960	1.31	3.95	33.2
1961	1.55	5.27	29.4
1962	1.46	5.92	25.0
1963	1.46	6.56	22.3
1964	2.36	8.73	27.0
1965	2.43	9.91	25.0
1966	3.13	10.4	30.1
1967	3.48	11.33	31.0
1968	4.21	14.26	30.0
1969	3.57	14.75	24.2
1970	2.24	12.17	18.4
1971	2.24	11.44	20.0
1972	3.50	17.01	21.0
1973	4.71	24.15	19.5
1974	20.43	49.75	41.1
1975	21.18	48.87	34.3
1976	20.65	68.71	30.1

Source: (i) A Konikoff, Trans-Jordan-An Economic Survey, (Jerusalem: Economic Research Institute of the Jewish Agency for Palestine, 1946), Table XVI, p.112. (covers exports and phosphate exports in 1943).

(ii) I.M.F., Balance of Payments Yearbooks, 1950-1959, (Washington D.C.: I.M.F, n.d), vols 8 and 12. (they coverdomestic exports during the period 1950-1959).

(iii) I.M.F., International Financial Statistics, (Washington, D.C.;International Monetary Fund, n.d.), supplement to 1972, p.215, (It covers phosphate rock exports during the period 1952 to 1971.

(iv) Central Bank of Jordan, Monthly Statistical Bulletin, Vol.13 No.3, March 1977,(It covers data on domestic exports over the period 1972 to 1976.

(v) J.P.M.C, Annual Reports 1972-1976, (Amman: n.d.) (they cover phosphate rock exports during the period 1972 to 1976).

by about 81 per cent as a result of the direct and indirect contacts made by J.P.M.C. with customers which led to increased sales to India, Japan, Yugoslavia, Turkey, Lebanon, and some other markets. Furthermore, J.P.M.C. was able to enter the Chinese market for the first time. Between 1969 and 1971 there was a 41 per cent decline in phosphate exports because of the decision taken by India not to import Jordanian phosphates due to political differences between the two countries. Sales to India in 1968 has constituted 44 per cent of total Jordanian phosphate exports. Another reason for the decline in exports during this period, was the civil disturbances in the country (1970/71) which resulted in continuous disorder, and a halt in the J.P.M.C's activities. These poor years actually led to great difficulties to the company in the sense that they caused a liquidity crisis. However, in 1972 J.P.M.C. was able to re-enter the Indian market and double its sales to Taiwan. The 1972 exports, therefore, grew by 46 per cent compared to their level in 1971 and thus, amounted to 0.952 million tons.[1] The exports over the period 1973/1974 grew at about 50 per cent and reached 1.5 million tons. Such a high growth can be attributed to the increased export levels to India, Japan, and Taiwan, and also to the penetration of new markets in Iran, S.Korea, and Malaysia. Exports, in 1975, unexpectedly declined by 24 per cent. The year 1975 was actually a bad one for all phosphate rock producers and exporters, because of consequences of the successive increases in selling prices in 1973 and 1974. Huge amounts of imported phosphate rock accumulated in importing countries by 1974 as importers bought more rock than needed as a safeguard against anticipated future price increases. Furthermore, the Americans sold

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1. The Financial Times, March 28, 1973.p.18

their fertilizer products at relatively low prices in the international market, which actually led to the closing of some fertilizer factories in Europe. The J.P.M.C. in view of the 1975 decline and after reviewing the international market situation altered its sales policy and decided to concentrate more on markets in Western Europe such as Italy and France, and concentrate less on markets located to the East of the Suez Canal.

Table VIII.18 shows the geographical distribution of markets for Jordanian phosphate rock and the relative importance of each by indicating the percentage contribution of each in total Jordanian phosphate rock exports for the period 1960 to 1975.

There are regular traditional markets for Jordanian phosphate rock, such as India, Japan, Czechoslovakia, Lebanon, Turkey and Ceylon. Other irregular markets include: Romania, Taiwan, People's Republic of China, Pakistan, Bulgaria, Poland, Syria and Italy. However, Jordanian phosphate rock has penetrated new markets in recent years, such as, France, Tanzania, Iran, Korea, Indonesia, Cambodia, BanglaDesh and Malaysia.

It is noted that India is the main importing country of Jordanian phosphate rock. In 1968 her imports constituted 44 per cent of total Jordanian phosphate rock exports. A number of conclusions can be drawn from a thorough inspection of Table VIII.18:-

1. Jordan has kept her main markets especially in India, Japan and Yugoslavia, while she lost the markets of Italy and Poland after 1967 June War due to the closing of the Suez Canal. Moreover, in 1970/71 Jordan lost the market of the People's Republic of China and as compensation gained the market of Taiwan. Italy turned

TABLE VIII.18

PERCENTAGE DISTRIBUTION OF JORDANIAN EXPORTS OF PHOSPHATE ROCK BY IMPORTING COUNTRIES

YEAR	TOTAL EXPORTS	INDIA	YUGOSLAVIA	TURKEY	CZECHOSLOVAKIA	ITALY	LEBANON
1960	329,006	22	45	-	15	-	3
1961	391,715	27	47	-	16	-	2
1962	371,640	35	36	-	22	-	4
1963	368,504	26	45	-	17	0.5	4
1964	627,074	19	29	15	13	0.7	3
1965	604,648	23	30	1	11	14	7
1966	754,736	40	26	-	8	15	5
1967	881,658	40	15	7	7	24	1
1968	1,095,227	44	19	9	3	1	11
1969	928,296	40	27	8	5	-	10
1970	658,056	10	29	15	7	-	22
1971	650,833	38	19	9	5	-	16
1972	952,371	41	5	9	5	-	10
1973	1,089,518	32	4	11	4	-	11
1974	1,468,894	37	6	8	3	-	9
1975	1,111,877	10	3	16	6	7	4

TABLE VIII.18(continued)

PERCENTAGE DISTRIBUTION OF JORDANIAN

EXPORTS OF PHOSPHATE ROCK BY

IMPORTING COUNTRIES

YEAR	TOTAL EXPORTS	JAPAN	PEOPLES REPUBLIC OF CHINA	POLAND	TAIWAN (CHINA)	ROMANIA	BULGARIA	TANZANIA
1960	329,006	-	-	12	-	-	-	-
1961	391,715	4	-	3	-	-	-	-
1962	371,640	1	-	5	-	-	-	-
1963	368,504	-	-	6	-	-	-	-
1964	627,074	6	-	-	-	-	4	-
1965	604,648	7	-	-	-	-	5	-
1966	754,736	-	4	-	-	-	-	-
1967	881,658	1	3	-	-	1	-	-
1968	1,095,227	2	5	-	-	-	-	-
1969	928,296	1	7	-	1	-	-	-
1970	658,056	1	9	-	2	1	-	-
1971	650,833	8	-	-	3	2	-	-
1972	952,371	19	-	-	4	-	-	4
1973	1,089,518	18	-	-	7	-	-	3
1974	1,468,894	18	-	-	7	-	1	6
1975	1,111,877	8	-	2	11	16	5	3

TABLE VIII.18 (continued)

PERCENTAGE DISTRIBUTION OF JORDANIAN EXPORTS OF PHOSPHATE ROCK BY IMPORTING COUNTRIES

YEAR	TOTAL EXPORTS	PAKISTAN	FRANCE	SPAIN	CEYLON	KOREA	BANGLADESH	GREECE	MALAYSIA
1960	329,006	-	-	2	-	-	-	1	-
1961	391,715	-	-	-	0.6	-	-	-	-
1962	371,640	-	-	-	-	-	-	-	-
1963	368,504	-	-	-	3	-	-	-	-
1964	627,074	1	0.5	-	1	-	-	-	-
1965	604,648	-	-	-	1	-	-	-	-
1966	754,736	-	-	-	2	-	-	-	-
1967	881,658	1	-	-	1	-	-	-	-
1968	1,095,227	3	-	-	2	-	-	-	-
1969	928,296	1	-	-	0.2	-	-	-	-
1970	658,056	5	-	-	0.3	-	-	-	-
1971	650,833	-	-	-	1	-	-	-	-
1972	952,371	2	-	-	0.4	-	-	-	-
1973	1,089,518	2	-	-	0.5	1	-	-	0.4
1974	1,468,894	3	-	-	0.2	1	-	-	1
1975	1,111,877	-	4	-	1.4	-	1	0.3	0.1

TABLE VIII.18 (continued)

PERCENTAGE DISTRIBUTION OF JORDANIAN EXPORTS OF PHOSPHATE ROCK BY IMPORTING COUNTRIES

YEAR	TOTAL EXPORTS	INDONESIA	CAMBODIA	SYRIA	BRITAIN
1960	329,006	-	-	-	-
1961	391,715	-	-	-	-
1962	371,640	-	-	-	-
1963	368,504	-	-	-	-
1964	627,074	-	-	-	-
1965	604,648	-	-	0.03	-
1966	754,736	-	-	0.03	-
1967	881,658	-	-	0.2	-
1968	1,095,227	-	-	0.2	-
1969	928,296	-	-	0.1	-
1970	658,056	-	-	0.1	-
1971	650,833	-	-	0.2	-
1972	952,371	-	-	0.1	-
1973	1,089,518	-	-	-	-
1974	1,468,894	-	-	-	-
1975	1,111,877	0.2	0.2	-	-

Source: Appendix VIII.D.

to Israel for her imports of phosphate rock after loosing the Jordanian phosphate rock. Exports of Israel to Italy increased from 48 thousand tons in 1967 to 150 thousand tons in 1972, later declining to 62 thousand tons in 1974. Poland turned to Morocco and Tunisia to compensate for the loss of the Jordanian phosphate rock. The Japanese market was characterized by its relative stability concerning imports of phosphate rock from exporting countries until 1970, when it decreased its imports from Senegal and Togo and turned to Jordan. Japan comes next to India in relative importance as an importer of Jordanian phosphate rock.

2. Jordan was unable to gain any place in Western European markets such as Belgium, France, Germany, Britain and Italy after 1967 June War because of the closing of the Suez Canal.

3. The increases in Jordanian exports of phosphate rock are mainly explained by increased demand by India and Japan, rather than by gaining new markets.

Furthermore, Jordan enjoys an important geographical location lying in the middle of countries which consume phosphate rock. The European market is the biggest importing market of phosphatic raw materials. In 1974,25,828 million tons of imports were recorded, while total world exports of phosphate rock were 55.721 million tons. Jordan contributed only 123 thousand tons which were exported to Turkey. While Morocco ranked first as an exporter of phosphate rock to Western Europe in 1974 (11.5 million tons), Jordan can take a greater share in the Western European markets without affecting Morocco's sales since Russia and the United States are reducing their exports to Western Europe. The United States exports to Western Europe were 4.103 million tons in 1973 and

were reduced to 3.868 million tons in 1974, while Russian exports amounted to 2.552 million tons in 1973 and were reduced to 2.470 million tons in 1974. These reductions were due to the increased domestic demand in both countries.

Furthermore, the opportunity is available for Jordan to increase her exports to some countries in Eastern Europe such as Rumania, and Bulgaria, in accordance with the commercial agreements signed with such countries in 1974.

B. EXPECTED FUTURE EXPORTS, 1976-1979.

The J.P.M.C. has prepared a sales forecast for the period 1976 to 1979 (Table VIII.19). It is believed that the J.P.M.C. will not be able to produce the required quantities of phosphate rock in 1976 and 1977 even if full capacity is used. However after 1978, the production capacity will be sufficient to satisfy this marketing plan, provided that the new benefication and drying facilities at El-Hassa are commissioned as scheduled.

TABLE VIII.19

EXPECTED FUTURE SALES OF JORDANIAN PHOSPHATE ROCK BY GRADE AND IMPORTING COUNTRIES, 1976 - 1979.

COUNTRY	GRADE	1976	1977	1978	1979
Taiwan	70/72	120	120	120	120
	73/75	50	70	70	70
India	70/72	200	200	200	200
	73/75	365	420	485	550
Sri Lanka	Jorphos	20	20	20	20
Japan	70/72	20	50	50	50
	73/75	180	350	400	450
Bangladesh	73/75	50	100	170	170
Pakistan	70/72	20	20	20	20
	73/75	100	100	100	100
Malaysia	70/72	40	40	50	50
Italy	73/75	200	200	240	260
Tanzania	73/75	100	100	100	100
Rumania	70/72	90	120	135	150
	73/75	210	280	315	350
Bulgaria	73/75	200	200	300	400
Turkey	70/72	120	120	120	120
	73/75	200	320	320	320
Yugoslavia	70/72	-	50	70	70
	73/75	120	150	150	170
Czechoslovakia	73/75	100	120	120	120
France and others	73/75	100	200	220	240
Iran	73/75	-	-	200	200
Indonesia	73/75	-	-	200	200
Phillipines	73/75	-	-	-	100
Total Aqaba	70/72	330	410	445	460
	Jorphos	20	20	20	20
	70/72	280	310	320	320
	73/75	1975	2770	3530	3940

TABLE VIII.19 (continued)

EXPECTED FUTURE SALES OF JORDANIAN PHOSPHATE ROCK BY GRADE AND IMPORTING COUNTRIES, 1976 - 1979

(in thousand tons)

COUNTRY	GRADE	1976	1977	1978	1979
Beirut					
Yugoslavia	70/72	100	100	100	100
Czechoslovakia	70/72	100	100	100	100
Turkey	70/72	100	100	100	100
Lebanon	70/72	100	110	120	130
Total Beirut and Lebanon	70/72	400	410	420	430
Grand Total	Jorphos	20	20	20	20
	70/72	730	820	865	890
	70/72	280	310	320	320
	73/75	1975	2770	3530	3940
		3005	3920	4735	5170
Russeifa		750	840	885	910
El Hassa		2255	3080	3850	4260

Source: Kingdom of Jordan, JPMC, Sales and Marketing Department.

SUMMARY AND CONCLUSIONS:

(i) The sales of Jordanian phosphate rock are usually made on F.O.B. basis though recently, sales on C.I.F. basis have been contracted due to the very strong competition in the world market. Sales, however, are usually contracted indirectly through agents in export markets or directly through negotiations between the J.P.M.C. or the Government and other chemical industries or foreign governments. It is noted that J.P.M.C. representatives in foreign markets are not of a particularly high calibre and are by no means sufficient.

(ii) Jordanian phosphate rock prices have followed the same trends as world phosphate rock prices since Jordan is strictly a price follower. The drop in phosphate rock prices in 1975 which resulted from the decline in world demand for phosphate rock, caused substantial reduction in the sales of Jordanian phosphate rock in world markets.

(iii) The marketing of Jordanian phosphate rock in world markets is hampered by the political situation in the Middle East, the policies of phosphate rock importing countries, the high content of impurities in the Jordanian rock, and the weaknesses in the Marketing and Sales Department of J.P.M.C.

(iv) Phosphate rock in Jordan is transported to ports of export by either railway trains or highway trucks. Trucks have been used most frequently between 1964 and 1974. Plans to improve the relative importance of using the railway in transporting the rock are underway.

(v) The Jordanian phosphate rock industry has long suffered from transportation problems related to the distance of ports of export from production areas, the limited capacity of both highway and railway systems, the passage through neighbouring countries, and the limited handling and storing capacities at ports of export. Such problems, undoubtedly, have led to high transport costs and thus to higher total costs. On the other hand, sea transport of Jordanian phosphate rock is hindered by the limited type and size of ships available in the Red Sea and adjacent areas.

(vi) The freight rates from Aqaba, grew substantially during 1960 to 1975 between Aqaba and destinations in the Mediterranean and South East Asia. The closing of the Suez Canal in 1967 affected Jordan's access to East European markets. The re-opening of the canal in 1975 benefited Jordan in reducing the shipping costs between Aqaba and destinations in the Mediterranean and the Black Sea areas and in increasing the number of ships available for transporting phosphate rock.

(vii) Finally, sales of Jordanian phosphate rock grew by an average 11.4 per cent per annum during the period 1960 to 1975, but in 1975, phosphate rock sales were 1.112 million tons, a decline of 24.31 per cent on the 1974 figure. The distribution of the J.P.M.C. sales according to geographical area indicates that India, by far, has been the main importing country of Jordanian phosphate rock. It is followed by Japan and Yugoslavia. It is important to note that Jordan was not able to capture a sizable share in West European markets because of the severe competition from Moroccan and U.S. producers.

CHAPTER NINE: SUMMARY AND CONCLUSIONS

In the preceeding chapters economic and commercial aspects of the Jordanian phosphate rock industry have been discussed. In addition, the relationship between this industry and world production and trade in phosphates was reviewed. This chapter summarises the main points developed in the previous chapters, and reaches some conclusions about the Jordanian phosphate rock industry and its future prospects.

Phosphate rock deposits are the source of the natural mineral resource "Phosphorus", an essential element for all living matter. Deposits of phosphate rock are widespread throughout the world, but the vast majority of reserves are in the United States, Morocco, and Russia. Current world reserves of phosphate rock exceed 46 million tons and are expected to last for many decades, considering the present rate of depletion and the discovery of new deposits.

World production of phosphate rock has increased exponentially since 1950 (7.1 per cent per year). However, the distribution pattern of world production is imbalanced, since the greater part of it comes from America, North Africa, and Russia. Continuous prospecting in Asia, South America, and other regions of the world, together with more active international trade, might correct this imbalance.

World consumption of phosphate rock also increased substantially over the same period and even outstripped production in the 1960's and in 1974 (7.6 per cent per year). This was a result of the increased world demand for chemical fertilizers and industrial goods. About 85 per cent of the total world production of phosphate rock is consumed in the manufacture of phosphatic fertilizers and their variants, and the remaining 15 per cent

is used in industrial products and processes. The distribution of world consumption of phosphate rock by geographical areas indicates that developed economies were the main consumers of phosphate rock, although the growth in consumption by developing economies was faster than in developed ones, indicating the increased application of phosphatic and other chemical fertilizers in agriculture, and the tendency to invest in chemical industries. The world pattern of consumption is more balanced since no one country imports more than 11 per cent of world exports of phosphate rock.

In view of developments in world production and consumption of phosphate rock and the expected growth rates of 8 per cent per year for world production and between 4 per cent and 6 per cent per year for world consumption of phosphates between 1976 and 1980, no shortage in the supply of phosphate rock is anticipated in the near future.

Prices of phosphate rock are quoted on a per ton basis, classified according to the percentage content of T.C.P. or B.P.L., and generally set by Morocco and Florida. The remaining producers of phosphates usually follow the lead of one or the other depending on which is at an advantage in their particular market. Price quotations only serve as a basis for negotiating the final selling prices. Between 1950 and 1973, phosphate rock world prices were relatively stable and producing countries competed on quality of products, negotiating power, and arrangement of shipments rather than on price. Between mid-1973 and mid-1975, phosphate rock prices soared because of the world market situation for phosphate rock. This situation benefited all producing countries for a short time and encouraged them to commence programmes for expanding their production capacities.

It also encouraged new producers to enter the market.

By mid-1975, world demand for phosphate rock declined unexpectedly because of the sudden depression in the international fertilizer and phosphate rock market and the huge stocks of phosphates accumulated by consuming countries in an attempt to hedge against even higher prices in the future. This situation hit the producing countries severely especially those depending on phosphate rock as a major export item. Consequently, world exports of phosphate rock did dip significantly and the intense competition among producing countries caused a fall in phosphate rock prices. The effects of the world market situation for phosphate rock between 1973 and 1975 will undoubtedly influence the market situation for phosphates for some years to come. Hence, phosphate rock prices can be expected to remain within their 1975 range in the near future.

The phosphate rock industry in Jordan has also been influenced by developments and problems in the Jordanian economy. Jordan is characterised by a relatively high growth rate in population resulting from the influx of refugees from Palestine in 1948 and 1967. These influxes imposed a heavy burden on an already over-strained economy. Undoubtedly, the refugees did bring with them into the country some capital and a well educated labour force. Recently, one third of the Jordanian labour force has been employed abroad. Those migrants caused a drain on Jordan's trained personnel and affected the ability of the country to implement and manage its economic and social plans for development.

Jordan has experienced real growth in some years between 1950 and 1975. However, such positive performance has been disrupted because of the conflict that exists within and between states in the Middle East and

the effects of such conflict on the availability and use of the already meagre economic resources in Jordan. There were significant structural changes in the relative importance of the Jordanian economic sectors. This was particularly evident in the services sector which grew substantially while the material producing sectors grew more slowly. Growth in the agricultural sector was hampered by under utilization of land and manpower, the heavy dependence on dry-farming, and the disproportionately low-credit facilities. The industrial sector which was virtually non-existent prior to 1950, has grown considerably between 1950 and 1975. However, such growth has been hampered by shortages in finance, managerial and technical know-how, and the limited domestic market.

On the fiscal side, the Government's current expenditure represented most of total expenditure, with expenditure on defence and public security accounting for more than half of it. Most of the Government's revenue is from external sources, much of it as foreign aid.

Jordan is also characterized by a chronic deficit in its trade balance. Such deficit has been financed mainly by foreign aid.

The Jordanian Government has played an important role in economic development. It has launched three plans for social and economic development since 1962 and has taken various measures to encourage industrialization. These plans and measures have succeeded at least in stimulating economic activity, and strengthening the necessary basis for economic and social development.

Therefore, to increase the overall economic performance, the Jordanian Government, in its future development plans should give more emphasis to the agricultural and industrial and mining sectors of the economy.

It should invest more in irrigation projects and ensure that adequate finance is available at low rates of interest. It should also take more active steps to encourage the growth of export and import substitution industries. In this respect the Jordanian phosphate rock industry can help considerably through forward and backward integration and diversification. In the short-run the J.P.M.C. can contribute more to investing in new development projects in the agricultural and industrial sectors. In the long-run, the J.P.M.C. should be able to establish plants for producing by-products from phosphate ore such as Uranium and Vanadium, in addition to other industrial products in which phosphate rock enters as an input.

After surveying developments in world production and trade in phosphates and in the Jordanian economy, developments in the Jordanian phosphate rock industry will now be reviewed.

Phosphate rock deposits cover 60 per cent of Jordan's surface area. Only deposits at Russeifa and El-Hassa are currently being exploited, although there are plans to mine the deposits at Shydieh by 1980. Recent estimates indicate that phosphate reserves in Jordan exceed 2,000 million tons. However, proven reserves total only 270 million tons, of which 30 million tons containing between 62 and 72 per cent T.C.P. are at Russeifa, while the remaining 140 million tons are at El-Hassa with a T.C.P. content of between 62 and 75 per cent.

All mining for phosphate is controlled by the Jordan Phosphate Mines Company, with the Jordanian Government owning the majority of its equity shares. Already, Jordan has a nominal capacity of 2 million tons per year of saleable concentrates. Plans exist to increase this capacity to about 6 million tons by 1981. At present, mainly two grades of phosphate rock

are produced, 70-72 per cent T.C.P. grade at both the Russeifa and El-Hassa mines, and 75-77 per cent T.C.P. grade at El-Hassa only. Lower grade product is stored in the vicinity of the mines for future utilization, mainly by the Chemical Fertilizer industry.

Jordan's exporting capability has been hit by the closing of the Suez Canal in 1967 and the closing of the Syrian/Jordanian border between July 1971 and April 1972. The Suez Canal had been used since 1960 to supply customers in Europe, but when it was closed, the Jordan Phosphate Mines Company had to revert to the rail link through Syria to Beirut in the Lebanon. This reduced the competitive strength of the company in Europe because of the increased cost of freight and the inadequate storage and loading facilities in the Port of Beirut. The re-opening of the Canal in 1975 has strengthened Jordan's position in relation to its East European markets which account for 45 per cent of the sales of J.P.M.C. The closing of the Syrian border, however, resulted in the stopping of all J.P.M.C. deliveries of phosphate rock to Mediterranean destinations. Improvements in the storage and loading facilities at the Port of Aqaba, however, resulted in considerable gains in Asian markets.

The cost of transport is a significant element in the export of such a heavy, bulky product, as phosphate rock. In this respect, Jordan's geographical isolation from European markets of phosphate rock imposes an additional handicap. Accordingly, Jordanian exports of phosphate rock to these markets are all but excluded. The problem of transport is alleviated in sales of rock to Asian markets, since Jordan enjoys a small advantage over its competitors in shipping there, hence, the problem of transport simply prohibits Jordan from competing in European markets yet does not prevent other producers competing in Asian Markets.

Therefore, in short, the establishment of the phosphate rock industry in Jordan has been one of the most significant economic developments in the economy. This industry now ranks as the country's major industrial employer. It has already contributed significantly towards the basic goals of industrialization, and diversification of industry. The industry also plays a vital role as a foreign exchange earner and to a lesser extent as an import saver.

In view of the present and expected future patterns of world production and trade in phosphates, and developments in the Jordanian economy, the establishment of a sizable export trade in phosphate rock will not be easy for the J.P.M.C. This is primarily because of Jordan's relatively small domestic market, her geographical position in relation to the major exporters and importers of phosphate rock, and the relatively high cost of freight compared with that of her competitors. However, areas of possible relief and direction of probable courses of action, indicated throughout this study, are summarized in this chapter.

a. There seems to be no possibility of easing the burden of transport cost unless the Government is prepared to provide assistance. This might be done in a variety of ways, such as the establishment of a shipping fleet, or special tax concessions for exports of phosphate rock. The establishment of a shipping fleet in Jordan might create enormous long-term benefits for the phosphate rock industry and all other export-oriented industries, as well as, lowering transport costs of imports through the Port of Aqaba. The availability of Jordanian shipping fleet might also alleviate the problem of the limited availability of ships in the Red Sea area.[1] In addition, by increasing the phosphate cargo hauled by trains, the J.P.M.C. will undoubtedly reduce its land transport costs.

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1. Obviously this proposal would require detailed investigation of costs and benefits.

b. Considering Jordan's competitive position and its relation to the competitive position of other phosphate rock exporters and the achievements of the J.P.M.C. in 1975, the planned production expansion of about 7 million tons by 1980 seems extremely difficult for the J.P.M.C. to sell. In this respect the establishment of a chemical fertilizers industry in Jordan will absorb the increasing stockpiles of phosphate rock at Russeifa and El-Hassa mines. In addition, it will bring about a considerable amount of foreign exchange and encourage Jordanian farmers to increase their use of such fertilizers.

c. Sales of Jordanian phosphate rock have been influenced by exogenous factors such as the closing of the Suez Canal between 1967 and 1975, the closing of the Syrian borders in 1970/1971, the boycott by India in 1970 because of Jordan's support to Pakistan about the BanglaDesh conflict, and the boycott by the People's Republic of China of Jordanian phosphates because of the Jordan's continued relations with Taiwan (China). Clearly, neither the J.P.M.C. nor the Jordanian Government could do much in the majority of such cases. However, if it could be possible to seperate business relations from political relations among states, there will be a chance for Jordan to avoid such circumstances. Nevertheless, it is expected that Jordanian phosphate rock exports will remain dependant to a large extent, on the prevalence of exogenous factors.

d. The marketing strategy of the J.P.M.C. ought to be more aggressive. This requires larger and more qualified sales force. In addition, it requires more and high calibre agents in export markets. These representations of the J.P.M.C. should be controlled by the company by regular visits and the necessity of presenting regular reports about world market developments in phosphate rock and chemical fertilizers.

The J.P.M.C. should concentrate on producing high grade products of phosphate rock (74 per cent to 77 per cent T.C.P. content) and should work on reducing the Chlorine and moisture content of its products. These measures if applied can significantly improve the competitive position of J.P.M.C. in world markets. The phosphate rock mined from El-Hassa has a chlorine content of 0.41 and moisture content of 1.50, while world demand for phosphate rock is for products with maximum chlorine content of 0.1 and moisture content of 1.0. Therefore, the J.P.M.C. should be prepared to install the needed benefication plants that would produce the higher grades which are widely demanded.

e. The analysis of the organization of the J.P.M.C. and in particular that of El-Hassa mine, presented in chapter seven, has shown that the organization is tightly managed as evident by the centralization of authority and the shortness in the administrative levels. It is noted that in the absence of the Director General and/or the Mine Manager, their respective departments are usually paralized. Hence, a basic re-organization is required. This could be done by increasing the number of administrative levels. In such a case the Director General or the Mine Manager would be able to concentrate on policy making.

f. In view of the general shortage of technically qualified personnel in the country and the rapidly rising trend in the prices of available labour, especially skilled ones, the J.P.M.C. should seriously acquire equipment to save the need for labour and at the same time give adequate internal and external training to possible candidates for the higher managerial levels in the company, and by applying more stringent criteria in the selection of new employees.

Finally, the phosphate rock industry in Jordan is expected to remain . . the major mineral industry and one of the main industrial enterprises in the country with respect to its contribution to economic development. However, it should be emphasised that Jordan should develop other mineral industries such as oil, manganese, potash, and copper to diversify its industrial base and avoid over dependence on one export item.

BIBLIOGRAPHY

BOOKS

Allen, R.G.D. Mathematical Analysis For Economists, (New York: Martins Press, 1960).

Anslen, Meluim and Barker, Clare Wright. Modern Marketing, (New York: McGraw-Hill Book Company Inc., 1939).

Aresvik, Oddvar. The Agricultural Development Of Jordan, (New York: Praeger Publishers, 1976).

Baker, M.J. Marketing: An Introductory Text, (London: Macmillan and Company Ltd., 1971).

Barnes, M.C., Fogg, A.H., Stepens, G.N., and Titman, C.G. Company Organization; Theory and Practice, (London: George Allen and Unwin Ltd., 1970).

Baumol, W.J. Economic Theory and Operations Analysis, (New Yersey: Prentice-Hall Inc., 1972).

Beals, Ralph E. Statistics for Economists, (Chicago: Rand McNally and Company, 1972).

Brbst, D.B. and Pratle, W.P. Geological Survey Professional, Paper 820, (Washington D.C.: United States Government Printing Office, 1973).

Brown, Murray. On the Theory and Measurement of Technological Change, (London: Cambridge University Press, 1966).

Cateora, Philip R. and Hess, Jhon M. International Marketing, (Chicago: Richard D. Irwin Inc., 1966).

Cooper, Charles A. and Alexander Sidney S. (eds). Economic Development and Population Growth in the Middle East, (New York: American Elserier Publishing Company Inc., 1972)

Edward, Edgar O. and Bell, Philip W. The Theory and Measurement of Business Income, (Berkeley: University of California Press, 1961).

Evans, Michael K. Microeconomic Activity, (New York: Harper and Row Publishers,

Fergnson, C.E. and Maurice, S.C. Economic Analysis, (Chicago: Richard and D. Irwin Inc., 1970).

Flarbuck, W.H. Organizational Growth and Development, (London: Hazell Watson and Viney Ltd., 1965).

Frisch, R. Theory of Production, (Amsterdam: D.Reidel Publishing Company, 1965).

Gay, P.W. and Smyth, R.L. The British Pottery Industry, (London: Butterworth and Company, 1974).

Griliches Z. and Ringstad, V. Economies of Scale and the Form of Production Function, (Amsterdam: North Holland Publishing Company, 1971).

Halbert, M. The Meaning and Sources of Marketing Theory, (New York: MacGraw-Hill Company Ltd., 1965).

Handerson, J.M. and Quandt, R.E. Microeconomic Theory, (New York: MacGraw-Hill Company Ltd., 1958).

Hanson, A.H. The Process of Planning:A Study of India's Five-Year Plan, (London: Oxford University Press, 1966).

Hazelton, J.E. The Economics of the Sulphar Industry, (Washington D.C.: The John Hopkins Press, 1976).

Hirshman, Albert. Exit, Voice and Loyalty Responses to Decline in Firms, Organizations and States, (Boston: Harvard University Press, 1970).

Jacob, K.D. Fertilizer Technology and Resources, (New York: Academic Press Inc., 1953).

Johansen, L. Production Functions, (Amsterdam: North Holland Publishing Company, 1972).

Jureen, L. and Wold, H. Demand Analysis, (New York: John Wiley and Sons, 1953).

Katz, George M. Production Functions, Foreign Investment and Growth, (Amsterdam: North Holland Publishing Company, 1969).

Klein, L.R. An Introduction to Econometrics, (Englewood Cliffs: Prentice-Hall Inc., 1962).

Konikoff, A. Trans-Jordan- An Economic Survey, (Jerusalem: Economic Research Institute of the Jewish Agency for Palestine, 1946).

Koyck, L.M. Distributed Lags and Investment Analysis, (Amsterdam: North Holland Publishing Company, 1954).

Kuznets, Simon. Economic Growth, (Chicago: Free Press of Glencoe, 1959).

Lamer, Mirco. The World Fertilizer Economy, (Palo Alto: Food Research Institute of Stanford University, 1957).

Leftwich, R.H. The Price System and Resource Allocation, (New York: Holt, Renihart, and Winston, 1961).

Lewis, William Arthur. Theory of Economic Growth, (London: George Allen Unwin Ltd., 1955).

Mason, Edward S. The Political Economy of Resource Use in Perspective on Conservation of Resources for Future, (Baltimore: The John Hopkins Press Inc., 1958).

Matell, Leroy H. and Spring, Francis P. Economics for Business Decisions, (New York: MacGraw-Hill Book Company, 1972).

Odeh, Hannah S. Economic Development of Jordan, 1954-1971, (Amman: The Jordanian Press Foundation, 1972).

Perrow, John. Economics, (London: University Tutoria Press Ltd., 1971).

Porter, R.S. Economic Trends in Jordan, 1954-1959, (Beirut: Middle East Development Division, 1961).

Smallbone, Douglas W. An Introduction to Marketing, (London: Staples Press, 1968).

Spencer, Milton H. Managerial Economics, (Chicago: Richard D. Irwin Inc., 1968).

Stigler G.J. The Theory of Price, (New York: Macmillan and Company Ltd., 1952).

Stuart, Robert Douglas. Penetrating the International Market, (New York: American Management Association Inc., 1965).

Swaán M. Gawi, S. and Dajani, F. Population, Manpower, and Development in Jordan, (Amman: n.pub., 1977).

Theil, Henry. Applied Economic Forecasting, (Amsterdam: North Holland Publishing Company, 1966).

Tilak, V.R.K. A Review of the Manpower Situation in the Middle East, (Beirut: 1969).

Vanwazer, J.R. Phosphorus and its Compounds, (New York: Interscience Publishers Inc., 1961).

Vernon, Jhon H. and Naylor, Thomas H. Microeconomics and Decision Models of the Firm, (New York: Harcourt and Brace and World Inc., 1969).

Whilser, T.C. Measuring Centralization of Control in Business Organization: A New Perspective in Organizational Research, (New York: John Wiley and Sons, 1964).

Yamane, Taro. Statistics: An Introductory Analysis, (New York: Harper and Row Publishers, 1964).

ARTICLES

Bartels, Robert. "The General Theory of Marketing", Journal of Marketing, Vol XXXII, January 1968.

Griliches, Zvi. "Distributed Lags Survey", Econometrica, Vol.XXXV, No.1, January 1967.

Harvey, Edwards. "Technology and The Structure of Organization, American Sociological Review, Vol.33, 1968.

Nadiri, M.I. "The Determinants of Trade Credit in The United States Manufacturing Sector", Econometrica, Vol. XXXVII, No.3, July 1969.

Freeman, M.R. "Phosphate Rock", Annual Mining Review, 1973.

_____. "Phosphate Rock", Annual Mining Review, 1972.

_____. "Phosphate Rock", Annual Mining Review, 1971.

_____. "Phosphate Rock", Annual Mining Review, 1970.

_____. "Phosphate Rock", Annual Mining Review, 1966.

UNITED NATIONS SOURCES

United Nations, F.A.O. Production Yearbook, 1974, (Rome: U.N. Publications, 1975).

_____, Production Yearbook, 1972, (Rome: U.N. Publications, 1973).

_____, Production Yearbook, 1965, (Rome; U.N. Publications, 1966).

_____,Production Yearbook, 1964, (Rome: U.N. Publications, 1965).

United Nations, Statistical Yearbook, 1955, (New York: United Nations Publications, 1956).

_____, Statistical Yearbook, 1957, (New York: United Nations Publications, 1958).

_____, Statistical Yearbook, 1960, (New York: U.N. Publications, 1961).

_____, Statistical Yearbook, 1965, (New York: U.N. Publications, 1966).

_____, Statistical Yearbook, 1970, (New York: U.N. Publications, 1971).

_____, Statistical Yearbook, 1972, (New York: U.N. Publications, 1973).

_____, Statistical Yearbook, 1974, (New York: U.N. Publications, 1975).

_____,Statistical Yearbook, 1975, (New York: U.N. Publications, 1976).

_____,Statistical Yearbook, 1976, (New York: U.N. Publications, 1977).

United Nations, Studies on Selected Development Problems in Various Countries in the Middle East, (New York: U.N. Publications, 1969).

_____, F.A.O. Jordan: Country Report, (Rome: U.N. Publications, 1967).

_____, Administrative Aspects of Planning, (New York: U.N. Publications, 1969).

_____, U.N. Economic andSocial Office in Beirut, Situation of Industry as a Whole and of Small Scale Industry in Particular, in Jordan, (Beirut: n.pub., 1968).

United Nations, National Resources of Developing Countries: Investigation, Development and Rational Utilization, (New York: U.N. Publications, 1970)

_____, Monthly Bulletin of Statistics, 1976, (Rome: U.N. Publications, 1977)

NEWSPAPERS

Al-Dusture, April 13,1976 (A Jordanian Daily Newspaper).

Financial Times, March 28, 1973.

Financial Times, April 21, 1976.

JORDANIAN SOURCES

Jordan Department of Statistics, The National Accounts, 1959-1966, (Amman: Department of Statistics Press, n.d.)

_____. The National Accounts 1967-1973, Amman: Department of Statistics Press, 1973).

_____. The Population Census, 1961, (Amman: Department of Statistics Press, 1964).

_____. The Employment Survey, 1974, (Amman: Department of Statistics Press, 1975).

_____. The Employment Survey, 1975, (Amman: n. pub, 1976).

_____. The Industrial Survey, 1965,(Amman: Department of Statistics Press,1966).

_____. The Industrial Survey, 1966, (Amman: Department of Statistics Press, 1967).

_____. The Industrial Survey, 1974, (Amman: Department of Statistics Press, 1976).

_____. Annual Statistical Yearbook, 1954, (Amman: n.pub, 1955).

_____. Annual Statistical Yearbook, 1955, (Amman: n.pub, 1956).

_____. Annual Statistical Yearbook, 1956, (Amman n.pub., 1957).

_____. Annual Statistical Yearbook, 1957, (Amman: n.pub., 1958).

_____. Annual Statistical Yearbook, 1958, (Amman: n.pub., 1959).

_____. Annual Statistical Yearbook, 1959, (Amman: n.pub., 1960).

_____. Annual Statistical Yearbook,1960, (Amman: n.pub., 1961).

_____. Annual Statistical Yearbook, 1961, (Amman: n.pub., 1962).

_____. Annual Statistical Yearbook, 1962, (Amman: n.pub., 1963).

_____. Annual Statistical Yearbook, 1963, (Amman: n.pub, 1964).

_____. Annual Statistical Yearbook, 1964, (Amman: n.pub, 1965).

Jordan Department of Statistics, Annual Statistical Yearbook, 1965, (Amman: n.pub., 1966).

_____. Annual Statistical Yearbook, 1966, (Amman n.pub., 1967).

_____. Annual Statistical Yearbook, 1967, (Amman n.pub., 1968).

_____. Annual Statistical Yearbook, 1968, (Amman: n.pub., 1969).

_____. Annual Statistical Yearbook, 1969, (Amman: n.pub., 1970).

_____. Annual Statistical Yearbook, 1970, (Amman: n.pub., 1971).

_____. Annual Statistical Yearbook, 1973, (Amman: n.pub., 1974).

The Jordan Development Board, The Seven-Year Programme For Economic Development of Jordan, 1964-1970, (Amman: The Commercial Press, 1971)

_____. The Five-Year Plan for Economic and Social Development, 1962-1967, (Amman: n.pub., 1962).

The National Planning Council, The Three-Year Plan For Economic and Social Development, 1973-1975, (Amman: The National Planning Council, 1973).

_____, The Five-Year Development Plan, 1976-1980 (Amman: The National Press, 1976).

_____, The Manpower Situation in Jordan - A Paper presented in the Manpower Seminar, April 2-8, 1972.

_____, Jordan Imports and Exports, (Amman: n.pub., 1976).

Ministry of Finance, Annual Report, 1954-1955, (Amman: The National Press, n.d.)

_____, Annual Report, 1955-1956, (Amman: El-Sherg Press. n.d.)

_____, Annual Report, 1956-1957, (Amman: The Cooperative Printing Press Workers' Society, n.d.)

_____, Annual Report, 1957-1958, (Amman: n.pub., n.d.)

_____, Annual Report, 1958-1959,, (Amman: El-Sharikah Tholathiah Press, n.d.)

Ministry of Finance, Annual Report, 1959-1960, (Amman: n.pub., n.d.)

_____, Annual Report, 1960-1961, (Amman: n.pub., n.d.)

Ministry of Finance, Annual Report, 1961-1962, (Amman: El-Sharikah Tholathiah Press, n.d.)

_____, Annual Report, 1962-1963, (Amman: The Co-operative Printing Press Workers' Society, n.d.)

_____, Annual Report, 1963-1964, (Amman: The National Press, n.d.)

_____, Annual Report, 1964-1965, (Amman: The Armed Forces Press, n.d.)

_____, Annual Report, 1965-1966, (Amman: The Arab Army Press, n.d.)

_____, Annual Report, 1966-1967, (Amman: The Aljamil Press, n.d.)

_____, Annual Report, 1967-1968, (Amman: The Arab Army Press, n.d.)

_____, Annual Report, 1968-1969, (Amman: n.pub., n.d.)

_____, Annual Report, 1969-1970, (Amman: The Co-operative Printing Press Workers' Society, n.d.)

_____, Annual Report, 1970-1971, (Amman: Al Hurriah Press, n.d.)

_____, Annual Report, 1971-1972, (Amman: Aljamil Press, n.d.)

Central Bank of Jordan, Annual Report, 1970, (Amman: Central Bank, 1971)

_____, Annual Report,1971, (Amman: Central Bank, 1972)

_____, Annual Report, 1972, (Amman: Central Bank, 1973)

_____, Annual Report, 1973, (Amman: Central Bank, 1974)

_____, Annual Report, 1974, (Amman: Central Bank, 1975)

_____, Annual Report, 1975, (Amman: Central Bank, 1976)

_____, Annual Report, 1976, (Amman: Central Bank, 1977)

_____, Annual Report, 1977, (Amman: Central Bank, 1978)

_____, Monthly Statistical Bulletin, Vol.5, No.12, December 1969.

_____, Monthly Statistical Bulletin, Vol.9, No.8, August 1973.

Central Bank of Jordan, Monthly Statistical Bulletin, Vol.10, No,3, March 1974.

_____, Monthly Statistical Bulletin, Vol.13, No.3, March 1977.

_____,Monthly Statistical Bulletin, Vol.13, No.11, November 1977.

Central Bank of Jordan, Law No.23 of 1971.

Ministry of Trade and Industry, The Encouragement and Guidance of Industry Law No.27 of 1955.

_____, The Encouragement of Foreign Capital Law No.78 of 1955.

The Ministry of National Economy, The Jordan Investment Promotion Office, The Encouragement of Investment Law No.1 of 1967

_____, The Encouragement of Investment Law No.53 of 1972.

Ministry of Culture and Information, El Tanmieh (a Jordanian Monthly Magazine),The Chemical Fertilizer Industry, p.89, No.260, April/May, 1975

Shuja Al-Asad, Population and Labour Force in Jordan, a Paper presented at the Conference of the International Labour Organization in Jordan, October 26-31, 1973.

The Jordan Phosphate Mines Company, Annual Report, 1960, (Amman: n.pub., 1961).

_____, Annual Report, 1961, (Amman: n.pub., 1962).

_____, Annual Report, 1962, (Amman: n.pub., 1963).

_____, Annual Report, 1963, (Amman: n.pub., 1964).

_____, Annual Report, 1964, (Amman: n.pub., 1965).

_____, Annual Report, 1965, (Amman: n.pub., 1966).

_____,Annual Report, 1966,(Amman: n.pub., 1967).

_____, Annual Report, 1967, (Amman: n.pub., 1968).

_____, Annual Report, 1968, (Amman: n.pub., 1969).

_____, Annual Report, 1969, (Amman: n.pub., 1970).

_____, Annual Report, 1970, (Amman: n.pub., 1971).

The Jordan Phosphate Mines Company, Annual Report, 1971, (Amman: n.pub., 1972).

_____, Annual Report, 1972, (Amman: n.pub., 1973).

_____, Annual Report, 1973, (Amman: n.pub., 1974).

_____, Annual Report, 1974, (Amman: n.pub., 1975).

_____, Annual Report, 1975, (Amman: n.pub., 1976).

_____, Annual Report, 1976, (Amman: n.pub., 1977).

Jordan Phosphate Mines Company, Modified Employment Manual at JPMC, an unpublished brochure, n.d.

_____, Report on The Phosphates of Jordan, (Amman: n.pub., 1972).

The Jordanian Cement Factories Limited., Annual Report, 1955, (Amman: n.pub., 1956).

_____, Annual Report, 1960, (Amman: n.pub., 1961).

_____, Annual Report, 1964, (Amman: n.pub., 1965).

_____, Annual Report, 1968, (Amman: n.pub, 1969).

_____, Annual Report, 1972, (Amman: n.pub., 1973).

_____, Annual Report, 1974, (Amman: n.pub., 1975).

OTHER SOURCES

Arab Central Statistical Bearue, Statistical Yearbook For Arab Countries, 1976, (Cairo: n.pub., 1976).

Bank of Morocco. Annual Report, 1973, (Rabat: Ekdal Press, 1973).

Stanford Research Institute. Markets for Jordan Phosphate Rock, (California: Menlo Park, 1963).

Robertson Research International Limited. A Market Appraisal of Rock Phosphate, (London: n.pub., 1974).

International Institute For Stratigic Studies. The Military Balance, (London: n.pub., 1973).

International Superphosphate Manufacturers' Association. Annual Report, 1964, (London: n.pub., 1965).

_____. Annual Report, 1965, (London: n.pub., 1966).

_____. Annual Report, 1966, (London: n.pub., 1967).

_____. Annual Report, 1967, (London: n.pub., 1968).

_____. Annual Report, 1968, (London: n.pub., 1969).

_____. Annual Report,1969, (London: n.pub., 1970).

_____. Annual Report, 1970, (London: n.pub., 1971).

_____. Annual Report, 1971, (London: n.pub., 1972).

_____. Annual Report, 1972, (London: n.pub., 1973).

_____. Annual Report, 1973, (London: n.pub., 1974).

_____. Annual Report, 1974, (London: n.pub., 1975).

International Monetary Fund, Balance of Payments Yearbook, 1950,(Washington D.C.: I.M.F., n.d.), Vol.8.

_____. Balance of Payments Yearbook, 1959, (Washington D.C.:I.M.F., n.d.) Vol.12

_____. International Financial Statistics, (Washington D.C.: I.M.F.,n.d.), Supplement to 1972.

The British Sulphur Company Limited., Statistical Supplement No.6 Nov/Dec. 1972, (London: n.pub., 1973).

_____. Statistical Supplement No.11, May/June 1975, (London n.pub., 1976).

Drewery, H.P. Phosphate Rock Shipping Through the Port of Aqaba, Jordan, (London: n.pub., 1975).

Fearnley and Eger. World Bulk Trade, 1973, (Norway: n.pub., 1974).

United States, U.S. Department of Interior, Mineral Facts and Problems, Bulletin 650, (New York: n.pub., 1970).

United States, U.S. Bearne of Mines, Mineral Yearbook, 1973, (Washington D.C.: U.S. Government Printing Office, 1974).

The Economist Inteligence Unit. The Expansion of Phosphate Industry in Jordan, (London: Economist Inteligence Unit Press, 1965).

University of Maryland, Atlas of the World's Resources: The Mineral Resources of the World, (New York: Prentice - Hall Inc., 1952).

THESES

Gary, Paul M. The United States Phosphate Rock Industry and World Trade in Phosphate Rock, M.B.A. Thesis, University of Pennsylvania, 1957.

Alawin , A. The Structure and Performance of Manufacturing Industry in Jordan, Ph.D. Thesis, Keele University, 1978.

PERSONAL INTERVIEWS

Interview with the Ex-Chairman of the Jordan Phosphate Mines Company, December 1975.

Interview with the Chairman of the JPMC, August 1976 and April 1977.

Interview with the Ex-Director General of JPMC, December 1975.

Interview with the Director General of JPMC, August 1976 and April 1977.

Interview with the Sales and Marketing Manager of JPMC, August 1976 and April 1977.

Interview with the Russeifa Mine Manager August 1976.

Interview with the El Hassa Mine Manager, July 1976.

Interviews with other members of staff of JPMC at the main offices in Amman, at the mines, and at the office at Aqaba Port, August 1976.

Interviews with members of staff of Ministry of Industry and Trade, December 1975.

Interviews with members of staff of Aqaba Railway Corporation, August 1976.

Interviews with members of staff of Aqaba Port Department, August 1976.

Interviews with Personnel in the Garages Union, August 1976.

Interview with the Head of the Engineering Section of the National Planning Council, August 1976.

APPENDIX I.A

ESTIMATE OF WORLD RESERVES OF PHOSPHATE ROCK AND APATITE.

(in thousand metric tons)

COUNTRY	TONNAGE	COUNTRY	TONNAGE
Tunisia	1,500,000	Brazil	573,000
Algeria	1,016,500	Ocean and Nauru Isls	282,245
Morocco	1,000,000	Makatae Islands	10,000
Egypt	179,000	Christmas Island	50,000
Europe (excl. U.S.S.R.)	435,126	Japan and Mandated Isls.	28,984
Russia	7,568,000	China	2,400
Palestine	4,000	Indochina	55
Canada	181	India	10,128
Mexico	214,500	Netherlands Indies	1,000
Other Countries	2,496		
Total	26,381,129		

Source: University of Maryland, The Mineral Resources of the World, (New York: Prentice-Hall Inc., 1952) p.145.

APPENDIX I.B

IMPORTANT PHOSPHATE DEPOSITS OF THE WORLD.

Location	Type of Mines[a]	Estimated Maximum amount of Minable reserves. (in million metric tons)
America		
Canada	P	0.18
United States	S.U.	13500
Curacao Island	U	1
Mexico	P	215
Brazil		570
Europe		
U.S.S.R.[b]	U.P.	7,600
Belgium	P)	440 (including all
France	P)	Europe except
Spain	P)	U.S.S.R.)
Asia		
China		3
India	P	10
Christmas Island	S	50
Israel)		
Jordan)		4
Africa		
Algeria	U.P.	1,000
Tunisia	U	2,000
Morocco	U	> 21,000
Egypt	S.U.	180
Seychelle Islands	S	
Union South Africa		
Oceana		
Australia		180 (of which the
Makata Island	S)	majority are in Nauru
Nauru Island	S)	and Ocean Islands
Ocean Island	S)	
Estimated total[c]		> 46700

a) S=strip mines, U = underground mines, P = pit mines
b) Includes Asiatic sections of U.S.S.R.
c) Includes values not shown in this tabulation.

Source: K.D. Jacob, Fertilizer Technology and Resources, (New York: Academic Press Inc., 1953), pp. 117 - 165.

APPENDIX I.C.

WORLD PRODUCTION OF PHOSPHATE ROCK, 1950-1975.

(in thousand metric tons)

YEAR	QUANTITY	YEAR	QUANTITY
1950	20250	1965	63000
1951	21250	1966	73100
1952	22400	1967	74800
1953	28600	1968	80700
1954	25100	1969	78700
1955	24600	1970	82000
1956	28600	1971	84500
1957	27200	1972	91000
1958	29200	1973	99300
1959	31400	1974	117100
1960	33500	1975	105300
1961	35500		
1962	36900		
1963	38400		
1964	44100		

Source: United Nations, Statistical Yearbook, 1957, (New York: U.N. publications, 1958), p.187 (for years 1950 to 1955), United Nations, Statistical yearbook, 1965, (New York: U.N. publications, 1966), p.209 (for years 1956 to 1964), United Nations, Statistical Yearbook, 1975, (New York: United Nations publications, 1976), p.218 (for years 1965 to 1974), and Al-Dustur, April 13, 1976 (A Jordanian daily newspaper).

APPENDIX I.D.

DISTRIBUTION OF WORLD PRODUCTION OF PHOSPHATE ROCK BY MAJOR AREAS.

(in thousand metric tons)

AREA	1965	1972	1974
America	27,342	36,582	42,039
Europe	14,490	21,658	30,680
Africa	16,254	24,479	31,266
Asia	2,331	4,277	8,548
Oceania	2,583	4,004	4,567
World Total	63,000	91,000	117,100

Source: United Nations, Statistical Yearbook, 1974, (New York: U.N. publications, 1975), p.197, and United Nations, Statistical Yearbook, 1975, (New York: U.N. publications, 1976), p.218.

APPENDIX I.E.

LEADING WORLD PRODUCERS OF PHOSPHATE ROCK. (in thousand metric tons)

COUNTRY	1948	1956	1960	1965	1967	1968	1969	1970	1971	1972	1973	1974	1975
United States	9,539	16,000	17,797	26,704	36,079	37,422	34,228	35,143	35,247	37,041	38,226	41,400	43,900
Russia	n.a.	5,350	7,000	13,500	16,300	17,700	19,250	20,800	21,650	22,000	22,150	22,500	24,100
Morocco	3,226	5,522	7,492	9,825	9,945	10,512	10,662	11,399	12,008	15,034	16,564	19,200	13,500
Tunisia	1,864	2,077	2,101	3,040	2,810	3,444	2,685	3,016	3,162	3,387	3,473	3,900	3,500
China	n.a.	n.a.	n.a.	900	n.a.	n.a.	n.a.	1,700	2,200	2,600	2,750	n.a.	n.a.
Nauru	268	1,491	1,248	1,693	1,798	2,254	2,193	2,114	1,867	2,000	2,100	2,300	2,500
World Total	17,100	28,600	33,500	63,000	74,800	80,700	78,700	82,000	84,500	91,000	99,300	117,100	105,300

Source: United Nations, Statistical Yearbooks, 1955 to 1975, (New York: U.N. publications, relevant years).

APPENDIX II.A

WORLD CONSUMPTION OF PHOSPHATE ROCK BY GEOGRAPHICAL AREAS, 1970 - 1974.

(IN THOUSAND METRIC TONS)

GEOGRAPHICAL AREA	1970	1971	1972	1973	1974
West Europe	17,857	18,783	20,898	22,880	25,407
East Europe	19,144	21,096	21,861	23,287	26,665
Europe	37,001	39,879	42,759	46,167	52,072
Africa	2,766	3,094	3,930	4,409	4,775
North America	24,946	26,432	29,466	31,460	35,017
Central America	848	973	1,202	1,501	1,744
South America	829	1,046	1,407	1,495	2,143
America	26,623	28,451	32,075	34,456	38,904
Asia	8,108	9,058	10,085	11,181	12,682
Oceania	3,400	3,260	2,720	4,262	4,133
World Total	77,898	83,742	91,569	100,475	112,565

Source: The British Sulphur Company Limited., Statistical Supplements No.6 Nov/Dec 1972 and No. 11 May/June 1975.

APPENDIX II.B

MAIN CONSUMING COUNTRIES OF PHOSPHATE ROCK, 1970 - 1974*.

(in thousand metric tons)

COUNTRY	1970	1971	1972	1973	1974
Belgium	1904	1976	2404	2441	2467
France	3677	3805	4148	4872	4753
W. Germany	2680	2850	3011	2979	3415
Italy	2050	1901	2109	1983	2024
Netherlands	1393	1562	1850	2178	2243
Spain	1385	1575	2009	2196	2802
Britain	1605	1710	1735	1979	2006
U.S.S.R.	12276	13600	13425	14479	16504
Poland	2011	2326	2654	2556	3009
S. Africa	1139	1155	1450	1565	1550
Tunisia	755	790	1051	1162	1324
U.S.A.	22836	24072	26796	28307	31453
Mexico	830	935	1167	1461	1670
Brazil	842	830	1114	1147	1615
China	2780	3325	3732	4174	4220
Japan	2857	2800	2962	3271	3943
Australia	2360	2160	1700	3012	3106
New Zealand	1040	1100	1020	1251	1028
E. Germany	1324	1410	1362	1448	1454
India	805	852	1102	992	1308
Czechoslovakia	1025	1045	1051	1032	1203

* These countries accounted for 86.5 percent in 1970, 85.8 percent in 1971, 85.1 percent in 1972, 84.4 percent in 1973 and 82.9 percent in 1974 of the total world consumption of phosphate rock.

Source: British Sulphur Company Limited., Statistical Supplements No.6 Nov/Dec 1972, and No.11 May/June 1975.

APPENDIX II.C.

WORLD PRODUCTION AND CONSUMPTION OF PHOSPHATIC FERTILIZERS.

(in thousand metric tons of P_2O_5)

Geographical Area	1971/1972 Production	1971/1972 Consumption	1972/1973 Production	1972/1973 Consumption
Africa	844	646	964	704
North and Central America	6529	5044	6612	5348
South America	300	711	379	976
Asia	2484	3106	2703	3366
Europe	8529	8120	9013	8384
Oceania	1103	1124	1250	1223
U.S.S.R.	2772	2442	2929	2757
World Total	22562	21192	2380	22766
Developed Market Economies	14949	12798	15559	13374
N. America	6322	4760	6360	5046
W. Europe	6496	5943	6862	6051
Oceania	1103	1122	1250	1230
Other	1028	973	1087	1047
Developing Market Economies	1697	2663	2033	3109
Africa	430	275	509	291
Latin America	507	995	631	1279
Near East	267	361	355	463
Far East	493	1031	539	1073
Other	-	2	-	2.0
Centrally-Planned Economies	5915	5731	6258	6283
Asia	1110	1112	1178	1193
Europe and U.S.S.R.	4805	4619	5080	5090

Source: United Nations, F.A.O., Production Yearbook 1974,(Rome: U.N. Publications,1975),pp 251-253.

APPENDIX II.D.

INPUT DATA FOR THE ESTIMATION OF
A DEMAND FUNCTION FOR WORLD PHOSPHATES

YEAR	CONSUMPTION OF PHOSPHATE ROCK (in million tons) (1)	INDEX NUMBER OF WORLD INCOME (BASE YEAR 1963) (2)	REAL AVERAGE PRICE PER TON OF PHOSPHATE ROCK (in U.S.Dollars). (3)	REAL AVERAGE PRICE PER TON OF PHOSPHATIC FERTILIZERS (in U.S. Dollars). (4)	REAL AVERAGE PRICE PER TON OF NITROGEN FERTILIZERS (in U.S. Dollars). (5)	REAL AVERAGE PRICE PER TON OF POTASH FERTILIZERS (in U.S. Dollars). (6)	REAL AVERAGE PRICE PER TON OF CHEMICAL FERTILIZERS (in U.S. Dollars). (7)	CONSUMPTION OF PHOSPHATE ROCK LAGGING BEHIND ONE YEAR. (in million tons) (8)
1963	48	100	8.22	235.42	404.41	132.17	272.15	44
1964	55	107	7.82	237.25	392.17	136.41	269.32	48
1965	60	113	7.24	243.03	385.57	142.81	272.16	55
1966	70	120	8.23	243.20	375.15	140.40	273.76	60
1967	72	125	7.99	237.36	362.96	134.69	265.62	70
1968	75	133	7.34	237.09	368.09	141.62	272.07	72
1969	77	141	7.19	238.98	369.93	141.59	274.67	75
1970	77	147	7.71	231.93	357.26	143.65	268.70	77
1971	84	154	7.88	258.64	394.13	158.82	269.90	77
1972	92	158	8.45	264.46	389.27	157.41	296.19	84
1973	101	166	9.53	337.62	483.14	139.52	355.59	92
1974	113	170	27.17	433.43	482.39	219.84	404.72	101
Average 1963/ 1974	77	136.7	9.56	266.53	397.04	149.08	293.49	71.25

Source: (i) United Nations, Production Yearbooks, 1964 - 1975, (New York: U.N. Publications, relevant years).

(ii) United Nations, Statistical Yearbook, 1972, (New York: U.N. Publications, 1973), p.50.

(iii) United Nations, Statistical Yearbook, 1975, (New York: U.N. Publications, 1976), p.10.

APPENDIX II.E.

WORLD CONSUMPTION OF CHEMICAL FERTILIZERS, 1963-1974.

(in million tons)

YEAR	PHOSPHATIC FERTILIZERS	NITORGEN FERTILIZERS	POTASH FERTILIZERS	TOTAL
1963	12.3	14.0	10.0	36.3
1964	13.8	16.3	11.0	41.1
1965	14.8	18.8	12.2	45.8
1966	16.0	21.8	13.0	50.8
1967	16.9	23.9	14.1	54.9
1968	18.1	26.6	14.7	59.4
1969	18.6	28.7	15.5	62.8
1970	19.8	31.8	16.7	68.3
1971	21.1	33.3	17.6	72.0
1972	22.5	35.7	18.8	77.0
1973	24.1	38.8	20.9	83.8
1974	22.9	38.9	19.9	81.7

Source: United Nations, Statistical Yearbooks, 1972 and 1975, (New York: U.N. Publications, 1973 and 1976), pp.542 - 550, pp.596 - 604, respectively.

APPENDIX II.F.

STATISTICAL RESULTS

	STATIC FUNCTIONS					DYNAMIC FUNCTIONS			
	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION
Intercept									
a	-0.02	+ 2.77	- 34.04	- 2.50	- 41.69	- 39.69	- 0.50	- 48.35	- 1.91
Price variable									
$Pph_{(t)}$	-0.16	- 0.35**	+ 0.36	+ 0.08		+ 0.53	+ 0.17		
	(0.22)	(0.18)	(0.39)	(0.09)		(0.97)	(0.11)		
$Pph_{(t-1)}$								+ 2.04	0.08
								(1.88)	(0.18)
$Pphf_{(t)}$	+ 3.98**	+ 2.30*							
	(1.08)	(0.61)							
$Pphf_{(t-1)}$						+ 0.43*	+ 1.45**	+ 0.50*	+ 1.88*
						(0.18)	(0.39)	(0.12)	(0.41)
$PN_{(t)}$	- 1.70	- 2.15							
	(1.28)	(0.57)							
$PN_{(t-1)}$						- 0.23*	- 1.58**	- 0.25*	- 1.52*
						(0.08)	(0.31)	(0.09)	(0.42)
$P_{K(t)}$	- 1.78**	- 0.24**							
	(0.31)	(0.28)							

APPENDIX II.F. (continued)

STATISTICAL RESULTS

	STATIC FUNCTIONS					DYNAMIC FUNCTIONS			
	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION
$PK_{(t-1)}$						+ 0.36*	+ 0.68**	+ 0.26	+ 0.42*
						(0.22)	(0.22)	(0.12)	(0.21)
$PF_{(t)}$			+ 0.08	+ 0.12	0.13**				
			(0.07)	(0.30)	(0.04)				
$PF_{(t-1)}$									
Income variable									
$I_{(t)}$	+ 1.66	+ 0.73*	+ 0.62**	+ 1.22*	0.60**	+ 0.33*	+ 0.52**		
	(1.90)	(0.18)		(0.14)	(0.07)	(0.09)	(0.11)		
$I_{(t-1)}$								+ 0.35*	+ 0.56*
								(0.09)	(0.14)
Consumption Variable									
$C_{(t-1)}$									
Adjusted Coefficient of Determinations (R^{-2})	0.98	0.98	0.97	0.96	0.97	0.99	0.996	0.992	0.992
Durbin-Watson Statistic	3.41	2.57	0.97	0.77	0.95	2.78	2.79	3.46	3.47

APPENDIX II.F. (continued)

STATISTICAL RESULTS

	DYNAMIC FUNCTIONS									
	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION
Intercept(a)	- 48.14	- 2.49	- 40.00	- 1.96	- 30.51	+ 0.13	- 19.33	- 1.40	- 19.09	- 1.38
Price Variable										
$Pph_{(t)}$					+ 0.65	+ 0.18	_ 0.02	- 0.003		
					(1.2)	(0.13)	(0.31)	(0.06)		
$Pph_{(t-1)}$										
$Pphf_{(t)}$										
$Pphf_{(t-1)}$	+ 0.51*	+ 1.88*	+ 0.53*	+ 1.93*	+ 0.44*	+ 1.46*				
	(0.10)	(0.31)	(0.12)	(0.37)	(0.22)	(0.48)				
$Pn_{(t)}$										
$Pn_{(t-1)}$	- 0.22*	- 1.44*	- 0.24*	- 1.52*	- 0.26*	- 1.68*				
	(0.07)	(0.33)	(0.09)	(0.39)	(0.10)	(0.38)				
$PK_{(t)}$										
$PK_{(t-1)}$	+ 0.25*	+ 0.42*	+ 0.25*	+ 0.41*	+ 0.38*	+ 0.70*				
	(0.10)	(0.16)	(0.12)	(0.19)	(0.28)	(0.28)				
$PF_{(t)}$							+ 0.10*	+ 0.35	+ 0.10+	+ 0.34
							(0.05)	(1.69)	(0.03)	(0.11)
$PF_{(t-1)}$										

APPENDIX II.F. (continued)

STATISTICAL RESULTS

	DYNAMIC FUNCTIONS									
	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION
Income Variable										
$I_{(t)}$	+ 0.36*	+ 0.60*								
	(0.07)	(0.11)								
$I_{(t-1)}$			+ 0.35*	+ 0.56*	+ 0.31*	+ 0.47*				
			(0.09)	(0.13)	(0.12)	(0.13)				
Consumption Variable										
$C_{(t-1)}$							+ 0.71*	+ 0.71*	+ 0.71*	+ 0.70*
							(0.24)	(3.50)	(0.20)	(0.18)
Adjusted Coefficient of Determinations										
(R^{-2})	0.993	0.994	0.99	0.992	0.991	0.994	0.988	0.987	0.988	0.987
Durbin-Watson statistic	3.02	3.20	3.16	3.37	2.86	2.82	2.01	2.17	1.97	2.15

APPENDIX II.F. (continued)

STATISTICAL RESULTS

	DYNAMIC FUNCTIONS							
	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION
Intercept								
a	_ 59.56	- 2.96	- 63.62	- 4.54	- 45.85	- 2.15	- 41.62	- 2.85
Price variable								
$Pph_{(t)}$	+ 0.08	+ 0.07			- 0.09	+ 0.03		
	(0.66)	(0.14)			(0.59)	(0.12)		
$Pph_{(t-1)}$								
$PphF_{(t)}$								
$PphF_{(t-1)}$								
$PN_{(t)}$								
$PN_{(t-1)}$								
$PK_{(t)}$								
$PK_{(t-1)}$								
$PF_{(t)}$								
$PF_{(t-1)}$	+ 0.20	+ 0.31	+ 0.22**	+ 0.64*	+ 0.18	+ 0.36	+ 0.17*	+ 0.51*
	(0.17)	(0.69)	(0.06)	(0.22)	(0.15)	(0.60)	(0.08)	(0.19)

APPENDIX II.F. (continued)

STATISTICAL RESULTS

	DYNAMIC FUNCTIONS							
	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION	LINEAR FUNCTION	LOGARITHMIC FUNCTION
Income Variable								
$I_{(t)}$	+ 0.58*	+ 1.10**	+ 0.58**	+ 1.07*	+ 0.26	+ 0.48	+ 0.27	+ 0.45
	(0.08)	(0.13)	(0.06)	(0.12)	(0.21)	(0.35)	(0.18)	(0.32)
$I_{(t-1)}$								
Consumption Variable								
$C_{(t-1)}$					+ 0.52	+ 0.48	+ 0.51*	+ 0.49*
					(0.31)	(0.26)	(0.28)	(0.24)
Adjusted Coefficient of Determination (R^{-2})	0.97	0.965	0.97	0.964	0.98	0.978	0.98	0.977
Durbin-Watson Statistic	1.36	1.12	1.36	1.17	2.22	2.13	2.20	2.15

* Significant at 0.05 level
** Significant at 0.01 level

Where:

$Pph_{(t)}$ stands for the real average price per ton of Phosphate rock in U.S. dollar.

$Pph_{(t-1)}$ stands for the real average price per ton of phosphate rock in U.S. Dollar lagging behind one year.

$Pphf_{(t)}$ stands for the real average price per ton of phosphatic fertilizers in U.S. Dollars.

$Pphf_{(t-1)}$ stands for Pphf lagging behind one year

$Pn_{(t)}$ and $PN_{(t-1)}$ stands for the real average prices per ton of nitrogen fertilizers in U.S. dollars at time (t) and lagging behind one year.

$PK_{(t)}$ and $PK_{(t-1)}$ stand for the real average prices per ton of potash fertilizers in U.S. dollars at time (t) and lagging behind one year.

$PF_{(t)}$ and $PF_{(t-1)}$ stands for the real average prices per ton of the mixture of the three chemical fertilizers at time (t) and lagging behind one year

$I_{(t)}$ and $I_{(t-1)}$ represent the index numbers of world income at time (t) and lagging behind one year.

and

$C_{(t-1)}$ stands for the world consumption of phosphate rock in tons lagging behind one year.

Source: Computer runs.

APPENDIX III.A

THE CURRENT BALANCE OF WORLD PRODUCTION AND CONSUMPTION OF PHOSPHATE ROCK, 1960-1974.

YEAR	PRODUCTION (in million tons)	CONSUMPTION (in million tons)
1960	33.5	40
1961	35.5	42
1962	36.9	44
1963	38.4	48
1964	44.1	55
1965	63.0	60
1966	73.1	70
1967	74.8	72
1968	80.7	75
1969	78.7	77
1970	82.0	78
1971	84.5	84
1972	91.0	92
1973	99.3	101
1974	117.1	113

Source: United Nations, Statistical Yearbooks, 1960 to 1975, (New York: U.N. publications, 1961-1976).

APPENDIX III.B

WORLD PRODUCTION CAPACITY AND DEMAND FOR PHOSPHATE ROCK (6 YEAR FORECAST)

(in million tons)

YEAR	MOROCCO	ALGERIA	TUNISIA	SPANISH SAHARA	TOGO	SENEGAL	S.AFRICA	JORDAN	ISRAEL	SYRIA	UAR	USA	USSR	CHINA	INDIA	PACIFIC ISLANDS	AUSTRALIA	PERU	CANADA	YUGOSLAVIA	OTHERS
1973	16.6	0.6	3.5	0.7	2.3	1.7	1.4	1.1	0.6	0.2	0.5	37.6	21.3	3.0	0.1	3.8	-	-	-	-	2.4
1974*	19.5	0.8	3.8	2.0	2.5	1.9	1.5	1.6	0.9	0.5	0.6	40.0	22.0	3.5	0.2	3.8	-	-	-	-	2.4
1975	21.0	0.8	4.0	3.2	2.5	2.0	1.5	2.6	1.0	1.0	0.6	40.0	23.0	4.0	0.2	3.8	-	-	0.5	-	2.5
1976	23.0	1.0	4.0	5.0	2.5	2.5	1.5	3.2	1.0	1.4	1.1	40.0	25.0	4.0	0.4	3.8	-	-	1.0	-	2.7
1977	26.0	1.8	4.5	6.6	2.5	3.0	2.8	4.9	1.0	2.0	1.1	42.0	26.0	5.0	0.8	3.8	2.0	-	1.0	-	3.0
1978	26.0	1.8	4.5	7.0	2.5	4.0	2.8	5.7	1.0	2.0	2.0	45.0	27.0	5.0	1.0	3.8	2.0	-	1.0	-	3.5
1979	28.0	2.0	5.0	8.0	2.5	4.0	2.8	6.0	1.0	2.0	3.0	48.0	28.0	5.5	1.2	3.8	2.5	-	1.0	0.3	4.0
1980	30.0	2.4	5.5	10.0	2.5	4.0	2.8	7.0	1.0	2.0	5.0	48.0	30.0	6.0	1.5	3.8	4.0	2.0	1.0	0.6	5.0

	WORLD PRODUCTION CAPACITY	ACTUAL CONSUMPTION	FUTURE DEMAND (7% ANNUAL GROWTH)	FUTURE DEMAND (5% ANNUAL GROWTH)	FUTURE DEMAND*
1973	99.3	101.0			
1974*	117.1	113.0			
1975	105.3		115.0	112.9	105.67
1976	123.1		123.1	118.5	111.87
1977	139.8		131.7	124.4	116.67
1978	147.6		140.9	130.7	121.47
1979	158.6		150.8	137.2	126.27
1980	174.1		161.3	144.1	131.09

Source: Calculated according to Forecasts.

* Estimated according to equation (8).

APPENDIX IV.A

VOLUME OF PHOSPHATE ROCK SHIPPED IN VESSELS BELOW 8,000 D.W.T.

(in thousand metric tons)

FROM / TO	MOROCCO			OTHER AFRICA			UNITED STATES			PACIFIC ISLS			OTHER AREAS			WORLD TOTAL		
	1968	1971	1973	1968	1971	1973	1968	1971	1973	1968	1971	1973	1968	1971	1973	1968	1971	1973
UK/Continent	3,836	4,222	2,670	1,713	1,429	1,838	258	32	-	90	-	-	1,218	1,252	1,011	7,115	6,935	5,497
Mediterranean	1,399	2,685	3,791	981	616	487	376	335	166	-	-	-	746	443	289	3,502	4,079	4,733
Japan	264	142	209	228	114	203	1,826	1,470	881	37	202	82	49	72	195	2,404	2,000	1,570
Australia	39	8	-	51	-	-	114	-	-	1,396	502	1,074	6	-	-	1,606	470	1,074
Other Areas	2,233	2,209	3,595	1,411	1,999	1,525	906	1,204	671	47	128	165	923	969	2,376	5,520	6,549	8,354
World Total	7,771	9,266	10,265	4,384	4,158	4,053	3,480	3,041	1,718	1,570	832	1,321	2,942	2,736	3,871	20,147	20,033	21,228
Percentage of world total (all ship types)	76.6	78.2	65.8	81.3	69.0	56.7	36.1	29.1	15.3	39.3	23.8	29.0	87.8	95.1	86.0	62.1	57.7	49.4

Source: Fearnley and Eger, World Bulk Trades, (Norway: 1973).

APPENDIX IV.B.

SIZES OF SHIP IN THE MAJOR BULK TRADES

(PERCENTAGE OF SEABORNE TRADE IN EACH COMMODITY)

YEAR / SIZE GROUP DWT	1965	1966	1967	1968	1969	1970	1971	1972	1973	1975
Iron Ore										
Under 18,000				19	15	14	15	10	9	
18/25,000				8	8	7	5	5	5	
25/40,000				19	18	19	16	15	13	
Over 40,000				54	59	60	64	70	73	
Coal										
Under 18,000				34	28	29	31	23	23	
18/25,000				14	13	11	9	10	8	
25/40,000				17	19	21	20	18	16	
Over 40,000				35	40	39	40	49	53	
Grain										
Under 18,000				39	40	41	37	29	32	
18/25,000				21	21	21	18	20	18	
25/40,000				30	26	27	32	36	37	
Over 40,000				10	13	11	13	15	13	
Bauxite/Alumina										
Under 18,000				40	37	41	35	31	31	
18/25,000				16	22	20	17	17	16	
25/40,000				40	35	32	38	39	36	
Over 40,000				4	6	7	10	13	17	
Phosphate										
Under 18,000	87	80	70	62	62	59	58	49	49	40
18/25,000	11	15	19	17	15	14	15	16	17	15
25/40,000	2	5	11	21	23	25	24	29	23	45
Over 40,000	-	-	-	-	-	2	3	6	11	-

Source: Fearnley and Eger, World Bulk Trade, (Norway: 1973), and H.P. Drewery Limited, Phosphate Rock Shipping Through The Port of Aqaba, Jordan, (London: 1975).

APPENDIX IV.C.

PHOSPHATE ROCK LOADING PORTS.

EXPORTER	TERMINAL	DEPTH (FT.)	MAX DRAFT (FT.)	MAX SHIP SIZE (DWT)*	LOADING RATE	DEVELOPMENTS
Florida	East Bay (Eastern Associated)	34'	33' 6"	30,000	3,000 tons hr	Shiploader can berth up to 115ft. beam
	East Bay (Rockport)	34'	33' 6"	30,000	3,000 tons/hr	Owned by Seaboard Coast Line, Rockport
	Port Tampa (Detsco)	30'	32'	25,000	1,200 tons/hr	
	Port Sutton (IMC)	34'	33' 6"	30,000	1,800 tons/hr	Shiploader can berth up to 95ft. beam
	Port Tampa (SCL)	34'	33' 6"	30,000	1,500 tons/hr	Shiploader can berth up to 80ft. beam
	Boca Grande (SCL)	31'	31'	20,000	900 tons/hr	Terminal now used for fertilizer shipments
	Jacksonville (Occidental	34'	31'	30,000	3,000 tons/hr	Controlling Depth being increased from 34ft to 38ft
	Morehead City	40'	40'	40,000	3,000 tons/hr	Controlling Depth is 40ft.
Curacao	Fulk Bay	26' - 28'	24'	5,000	200 tons/hr	LOA (Max) is limited to 360ft.
Morocco	Casablanca	41'	38'	40,000	2,000 tons/hr	
	Safi	33'	31'	25,000	1,000 tons/hr	LOA is limited to 660ft.
Tunisia	Sfax (Gafsa)	33'	33'	25,000	1,750 tons/hr	Controlling Depth being increased from 33ft to 40ft
	La Goulette (Gafsa)		27' 6"	20,000	400 tons/hr	
Algeria	Annaba	31'	30' 6"	15,000	350 tons/hr	
Sp. Sahara	El Aaiun (Fosbucraa)	57'	55'	100,000	4,000 tons/hr	Three Berths
Senegal	Dakar	37'	26' & 36'	30,000	1,000 tons/hr	Two Berths
Togo	Kpeme	41'	38'	40,000	2,500 tons/hr	
Syria	Tartous	35'	33'	25,000	1,000 tons/hr	

APPENDIX IV.C. (continued)

PHOSPHATE ROCK LOADING PORTS

EXPORTER	TERMINAL	DEPTH (FT.)	MAX DRAFT (FT.)	MAX SHIP SIZE (DWT)*	LOADING RATE	DEVELOPMENTS
Israel	Ashdod Eilath Haifa	36' 39' 34'	36' 39' 34'	20,000 25,000 15,000	600 tons/hr 1,200 tons/hr 300 tons/hr	
Jordan	Aqaba Beirut (via Lebanon)	32' & 50'	32' & 40' 27'	50,000 18,000	500 & 1,500 tons/hr 500 tons/hr	
UAR	Kosseir Safaga	 31'	25' 27' 6"	10,000 15,000	200 tons/hr 200 tons/hr	
Nauru Is		Deep water	35'	33,000	2,500 tons/hr	LOA is limited to 630ft. beam to 90ft.
Ocean Is		Deep water	34' 6"	22,000	1,300 tons/hr	LOA is limited to 575ft. beam to 75ft.
Christmas Is		Deep water	35'	33,000	1,350 tons/hr	LOA is limited to 630ft. beam to 90ft.
USSR	Murmansk	34'	32'	20,000	1,000 tons/hr	

* With full deadweight cargo, allowing for length/beam limitations, loading equipment etc.

Source: H.P.Drewery, Phosphate Rock Shipping Through The Port of Aqaba, Jordan, (London 1975)

APPENDIX IV.D.

PHOSPHATE ROCK DISCHARGING PORTS

IMPORTER	PORT	DEPTH (FT.)	MAXIMUM DRAFT (FT.)	MAXIMUM SHIP SIZE (DWT)	AVERAGE DISCHARGING RATE	DEVELOPMENTS
Sweden	Landskrona	36'	33' 6"	25,000	6/8,000 tons/day	
Belgium	Antwerp Ghent	45'	36' 6" - 42' 12.25m 40' 2"	70,000	up to 10,000 tons/day 2,500/3,000 tons/day	
France	Dunkirk Rouen	14m 45' 11"	41' 27' on NT 33' on ST	70,000 25,000	up to 10,000 tons/day (1,500 T/H) up to 10,000 tons/day	
W. Germany	Hamburg Weserport	40' 29' 6"	42' 6" 35'	40,000 25,000	1,200/1,600 T/Shift up to 6,000 tons/day	
Netherlands	Amsterdam Rotterdam	31' 42' 8"	43' 65'	20,000 60,000	up to 7,000 tons/day up to 6,000/6,500 tons/day	
Italy	Genoa Trieste Venice	40' 28' - 31'	31' - 40' 32' 28' (29' High) (30' Water)	20,000	up to 3,000 tons/day up to 1,500/2,000 tons/day	
Yugoslavia	Koper	33'	31'	20,000	1,000 tons/day	
Rumania	Constantza	36'	44'	33,000	up to 3,500 tons/day	
Bulgaria	Varna	20' - 30'	30'	10,000	750/900 tons/day	
Poland	Gydnia Szczecin	28' 28'	33' 6" 28'	28,328 24,100	up to 2,500 tons/day " " "	
Spain	Huelva Seville Tarragona Valencia	25' 29' and 33' 30'	25' 24' 32' 30'	15,000 15/18,000 20,000	10 cranes of 3-12 T cap 500 - 800 T per person in working day.	

APPENDIX IV.D.

PHOSPHATE ROCK DISCHARGING PORTS (continued)

IMPORTER	PORT	DEPTH (FT.)	MAXIMUM DRAFT (FT.)	MAXIMUM SHIP SIZE (DWT)	AVERAGE DISCHARGING RATE	DEVELOPMENTS
Canada	Vancouver	35'	43'	40,000	up to 2,000 tons/hour or 10,000 day	
Brazil	Paranagua	29'	23' Official 24' High 27' Springtide	15,000	up to 2,000 tons/day	
	Rio Frande	26' - 29'	29'	20,000		Superport under construction eventually to handle fertilisers
	Santos	11m 36' 1"	30' - 32'	21,000	up to 5,000 tons/day	
Iran	Bandar Shaphur	29' - 34'	29' higher, dep. on tide	15,000	Ships gear 750 tons/day	
Pakistan	Karachi	26' - 31'	32'	15/18,000	700 tons/day	Dredging and deepening of channel to 34'
India	Bombay	34' (Indira berth)	Variable due to state of tide		1,000 tons/day	Facilities planned to cater for 80,000 DWT
	Calcutta (Haldia)	30'				
	Bhavnagar	24' approx	30'	20,000	650/1,000 tons/day	
	Cochin	30'	31'	9,500	650 tons/day	Bulk berth being extended to 800' proposal to have mech. fert. berth for bulk phos. on 40' draft in 5th. plan.
			30'	20,000	650 tons/day	
	Kandla	35' new 28-31' Old	28' - 31'	25,000	New Unloader for potash able to discharge 500 tons/hour	
	Karwar		Unlimited as load discharge at sea	Unlimited	650 tons/day	

APPENDIX IV.D.

PHOSPHATE ROCK DISCHARGING PORTS (continued)

IMPORTER	PORT	DEPTH (FT)	MAXIMUM DRAFT (FT.)	MAXIMUM SHIP SIZE (DWT)	AVERAGE DISCHARGE RATE	DEVELOPMENTS
Japan	Akita	9m 29' 6"	9.6m 31' 6"	15,000	200/270 tons/hour by shore crane	
	Chiba	12m and 39'4½" 10.5m and 34'5½"	14m 45' 11"	27,000		
	Fushiki	9.5m and 31'2"	31' summer 30' winter	21,700		2,000 2,5000
	Moji	32' 9"	33'	21,500	40 tons/hour per gang per hatch	
	Niihama	9m 29' 6"	9.5m 31 2"	15/18,000	70/90 tons by ships crane	
S. Korea	Chinhae	33'	33'	20,000	up to 6,500 tons/day, gantry crane 2,000 tons/day, ships' crane	
	Ulsan	30'	33'	20,000	up to 5,000 tons/day	
Australia	Adelaide	24'	31'		up to 4,000 tons/day	Channel being widened to 9.8m Work in progress to deepen inner channel to 10m by end 1975.
	Geraldton	28' 6"	28' 6"	15,000	2,000 tons/day	
	Melbourne (Yarra)	31'	35'	21,000	4,000 tons/day	
	Newcastle (NSW)	33'	38'	23,000	650 tons/hour	
	Port Lincoln	8.5m 27'10½"	10m 32' 9.3/4"		5,000 tons/day	Inner berth under construction to accommodate phosphorous vessels up to 3,500 DWT

APPENDIX IV.D.

PHOSPHATE ROCK DISCHARGING PORTS (continued)

IMPORTER	PORT	DEPTH (FT.)	MAXIMUM DRAFT (FT.)	MAXIMUM SHIP SIZE (DWT)	AVERAGE DISCHARGE RATE	DEVELOPMENTS
New Zealand	Bluff	25' - 32'	30'	20,000	2,000 tons/day	Harbour being dredged to give workable draft of 34'
	Napier	35'	29' - 31'	21,000	2,000 tons/day	
	Whangarei	31'	31'	21,000	2,000 tons/day	

Source: H.P Drewery Limited., Phosphate Rock Shipping Through The Port of Aqaba, Jordan, (London 1975).

APPENDIX IV.E.

EVOLUTION OF SINGLE VOYAGE FREIGHT RATES
FOR FULL CARGOES OF PHOSPHATE ROCK: 1971/74.
(US Dollars per Cargo Ton)

TRADE		AQABA-INDIA	TAMPA-INDIA	CASABLANCA-INDIA
DISTANCE:		3,100	11,500	9,500
SIZE: TERMS:		5/15,000 DWT 3500/650 F1O	5/15,000 DWT 5000/650 F1O (Free-in-out)	5/15,000 DWT scale load/650 (discharge free)
1971	June	5.75- 6.25	10.00-10.40	7.90- 8.30
	July	5.60- 6.00	9.80-10.20	7.80- 8.20
	August	5.55- 6.65	9.65- 9.95	7.80- 8.10
	September	5.50- 5.60	9.45- 9.75	7.70- 8.00
	October	5.45- 5.75	9.25- 9.55	7.60- 7.90
	November	5.65- 5.75	8.90- 9.10	7.60- 7.80
	December	5.75- 6.25	9.90-10.90	7.70- 8.00
1972	January	5.50- 5.90	10.30-10.70	7.50- 7.70
	February	5.20- 5.80	10.35-10.75	7.60- 7.80
	March	5.25- 5.15	8.80- 9.00	7.65- 7.95
	April	5.15- 5.35	8.90- 9.60	7.70- 8.00
	May	4.90- 5.10	9.00- 9.20	7.65- 7.95
	June	5.00- 5.40	9.10- 9.90	7.60- 7.90
	July	4.75- 5.15	10.75-11.05	7.60- 7.80
	August	4.75- 5.15	10.75-11.05	7.60- 7.80
	September	4.75- 5.15	10.75-11.05	7.65- 7.95
	October	5.00- 5.20	13.30-13.70	10.90-11.40
	November	5.80- 6.85	13.80-15.80	11.10-11.60
	December	6.45- 6.55	13.95-15.05	11.30-11.90
1973	January	8.20- 8.30	17.05-17.45	13.55-14.25
	February	8.25- 8.75	18.00-18.25	13.50-14.00
	March	9.75-10.25	18.25-18.75	15.90-16.90
	April	10.00-11.50	19.25-20.50	15.75-16.25
	May	10.00-11.20	18.90-19.10	15.75-16.25
	June	10.50-11.30	18.90-19.70	16.15-16.85
	July	11.00-11.50	19.00-20.00	23.15-25.15
	August	11.50-12.00	19.95-20.45	25.15-27.15
	September	12.50-14.40	20.75-23.65	25.75-27.25
	October	14.40-14.60	23.65-23.75	29.50-31.50
	November	14.90-15.50	23.70-24.30	32.75-34.75
	December	15.50-16.50	24.00-24.80	37.50-40.50
1974	January	19.00-20.00	26.90-28.90	38.25-40.25
	February	19.00-19.50	27.00-28.60	38.25-39.75
	March	19.00-20.00	28.50-29.50	39.00-40.50
	April	19.20-20.00	28.40-29.20	39.25-41.25
	May	19.25-19.50	29.20-30.40	40.75-42.75
	June	20.00-20.75	29.20-31.60	43.25-45.75
	July	19.00-19.50	29.00-29.60	46.00-49.00
	August	18.50-19.25	27.85-27.95	43.75-46.25
	September	18.50-18.75	27.30-27.50	39.00-41.00
	October	18.50-19.00	27.15-27.65	39.00-40.75
	November	18.00-19.00	26.00-27.60	39.50-40.50
	December	16.50-17.50	24.10-24.90	24.00-26.00

Source: H.P.Drewery Limited, Phosphate Rock Shipping Through The Port of Aqaba, Jordan, (London: 1975).

APPENDIX IV.F.

CHARGES AT PRINCIPAL PHOSPHATE LOADING PORTS
(basis a ship of 15,000 DWT)

PORT: COUNTRY: DAYS IN PORT:	TAMPA Florida 5	CASABLANCA Morocco 4	AQABA Jordan 5
CHARGES (in US $) :			
Light Dues	paid	n.a.	n.a.
Harbour Dues	140	1,170	985
Tonnage Tax	paid	2,370	n.a.
Pilotage, etc	475	440	305
Towage	1,350	835	695
Customs	paid	paid	paid
Agency	560	265	380
Other	355	885	255
TOTAL CHARGES	2,880	5,965	2,620
Cost per Cargo Ton (US $) :	0.20	0.42	0.18

Source: H.P.Drewery Limited., Phosphate Rock Shipping Through The Port of Aqaba Port. Jordan, (London: 1975).

APPENDIX IV.G

CHARGES AT PRINCIPAL PHOSPHATE DISCHARGING PORTS

(basis a ship of 15,000 DWT)

PORT: COUNTRY: DAYS IN PORT:	IMMINGHAM United Kingdom 7	ROUEN France 4	BOMBAY India 13
CHARGES (in US $) :			
Light Dues	1,535	none	415
Harbour Dues	9,950	3,075	1,560
Tonnage Tax	none	none	none
Pilotage, etc.,	910	990	425
Towage	1,940	1,540	585
Customs	paid	185	paid
Agency	765	855	710
Other	105	145	335
TOTAL CHARGES	15,205	6,790	4,030
Cost per Cargo Ton (US $) :	1.07	0.48	0.28

Source: H.P. Drewery Limited., Phosphate Rock Shipping Through The Port of Aqaba, Jordan, (London: 1975).

APPENDIX IV.H

TOTAL WORLD EXPORTS OF PHOSPHATE ROCK BY MAIN PRODUCING COUNTRIES, 1964 - 1974.

(in thousand tons)

YEAR	MOROCCO	UNITED STATES	TUNISIA	TOGO	JORDAN	ISRAEL	SENEGAL	WORLD EXPORTS
1964	10116	5744	2117	778	627	177	713	25442
1965	9553	6863	2308	981	605	301	822	26131
1966	9203	8364	2395	1111	755	455	1075	28991
1967	9344	9306	2235	1123	869	452	805	32748
1968	10094	10919	2460	1357	1071	729	971	37438
1969	10262	10230	1850	1464	925	870	910	36666
1970	11314	10600	2109	1507	658	760	1050	38797
1971	11886	11469	2410	1762	651	574	1273	40658
1972	13558	12464	2305	1855	952	638	1546	43511
1973	16104	12623	2225	2292	1080	540	1672	49163
1974	18690	12915	2407	2633	1447	752	1799	55721

Source: United Nations, Statistical Yearbooks, 1964 to 1975, (New York: U.N Publications, 1964 to 1975), and International Superphosphate Manufacturers' Association (ISMA), Annual Phosphate Rock Statistics, 1964 - 1974, (London).

APPENDIX IV.I.1.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1964.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	45	-	-	185	-	119	39	627
Israel	12	-	7	28	3	-	30	-	-	39	177
Tunisia	-	546	199	427	53	30	167	-	207	31	2,117
Morocco	994	1,696	901	291	698	519	76	784	73	216	10,116
U.S.A.	22	30	792	726	237	-	-	-	-	1,611	5,744
Senegal	-	-	217	-	144	-	-	-	-	155	713
Togo	28	130	68	67	7	-	19	-	-	106	778
Total	1,117	2,494	2,199	1,716	1,510	549	642	784	n.a.*	2,348	25,442

* n.a. means not available.

Source: International Superphosphate Manufacturers' Association (ISMA), Annual Phosphate Rock Statistics, 1964, (London:1965).

APPENDIX IV.I.2.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1965.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	84	-	-	180	-	139	42	605
Israel	-	-	-	34	-	-	-	-	-	34	301
Tunisia	-	651	250	360	45	75	196	-	260	26	2,308
Morocco	1,057	1,834	585	358	885	456	12	604	22	274	9,553
U.S.A.	-	51	932	812	321	-	-	-	50	1,653	6,863
Senegal	-	34	253	-	154	-	-	-	-	174	822
Togo	66	220	132	91	11	-	-	-	-	113	981
Total	1,186	2,849	2,506	1,650	1,694	613	472	614	n.a.*	2,397	26,131

* n.a. means not available.

Source: ISMA, Annual Phosphate Rock Statistics 1965, (London: 1966).

APPENDIX IV.I.3.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1966.

(in thousand tons)

IMPORTER / EXPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	YUGOSLAVIA	POLAND	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	114	-	-	194	33	303	-	755
Israel	12	4	6	92	4	-	84	-	-	38	455
Tunisia	-	614	166	313	44	140	257	79	271	12	2,395
Morocco	968	1,736	413	443	821	368	46	579	203	330	9,203
U.S.A.	14	122	1,192	1,042	335	-	45	-	27	1,677	8,364
Senegal	-	58	301	5	194	-	-	-	-	193	1,075
Togo	47	328	123	41	-	-	-	-	51	109	1,111
Total	1,200	2,978	2,560	1,880	1,649	699	359	736	n.a.	2,526	28,991

Source: ISMA, Annual Phosphate Rock Statistics, 1966, (London:1967).

APPENDIX IV.1.4.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1967.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	YUGOSLAVIA	POLAND	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	208	-	-	131	27	354	8	869
Israel	8	21	14	48	47	-	91	-	-	38	452
Tunisia	-	572	158	187	26	247	312	59	27	11	2,235
Morocco	1,154	1,822	258	398	893	320	14	652	10	436	9,344
U.S.A.	126	129	1,220	1,015	311	-	22	-	79	1,936	9,306
Senegal	-	78	167	18	141	-	-	-	-	192	805
Togo	65	107	65	43	12	-	-	-	33	107	1,123
Total	1,546	3,052	2,447	2,032	1,666	699	1,082	894	n.a.	2,728	32,748

Source: ISMA, Annual Phosphate Rock Statistics, 1967, (London: 1968).

APPENDIX IV.I.5.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1968.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	13	-	-	210	56	479	26	1,071
Israel	18	20	19	108	105	-	99	-	-	26	729
Tunisia	-	634	97	128	44	344	374	87	48	6	2,460
Morocco	1,186	1,740	202	450	1,074	656	65	533	21	485	10,094
U.S.A.	319	202	1,328	1,241	265	-	18	-	271	2,516	10,919
Senegal	3	151	51	24	144	-	-	-	10	185	971
Togo	80	569	106	22	-	-	-	-	-	155	1,357
Total	1,827	3,403	2,726	2,192	1,870	1,505	891	895	n.a.	3,465	37,438

Source: ISMA, Annual Phosphate Rock Statistics, 1968, (London:1969).

APPENDIX IV.I.6.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1969.

(in thousand tons)

IMPORTER / EXPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	-	-	-	249	67	368	9	925
Israel	8	123	-	119	145	-	24	-	-	32	870
Tunisia	16	491	70	88	44	310	260	-	-	-	1,850
Morocco	1,339	1,612	251	444	1,056	950	114	567	14	494	10,262
U.S.A.	250	283	1,219	1,233	108	-	-	-	278	1,858	10,230
Senegal	31	186	67	31	140	-	-	-	-	149	910
Togo	93	737	139	9	-	-	-	-	-	158	1,464
Total	1,848	3,534	2,710	1,913	1,648	1,851	718	1,052	n.a.	2,970	36,666

Source: ISMA, Annual Phosphate Rock Statistics, 1969, (London:1970).

APPENDIX IV.I.7

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1970.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	-	-	-	193	59	63	5	658
Israel	25	83	4	130	121	-	18	-	-	18	760
Tunisia	110	404	92	63	63	441	192	-	-	-	2,109
Morocco	1,146	1,639	471	616	1,091	697	390	592	154	596	11,314
U.S.A.	360	360	1,326	1,196	26	-	1	-	463	1,871	10,600
Senegal	-	283	61	49	173	5	-	-	25	144	1,050
Togo	87	849	100	-	-	-	-	-	-	128	1,507
Total	1,828	3,703	2,997	2,053	1,602	2,076	842	1,094	n.a.	3,131	38,797

Source: ISMA, Annual Phosphate Rock Statistics, 1970, (London:1971).

APPENDIX IV.I.8.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1971.

(in thousand tons)

IMPORTER / EXPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	WORLD TOTAL
Jordan	-	-	-	-	-	-	127	-	249	49	651
Israel	-	38	32	112	-	-	96	-	-	-	574
Tunisia	14	414	96	34	83	451	21	24	104	-	2,410
Morocco	1,287	1,501	370	585	1,178	960	-	623	101	457	11,886
U.S.A.	442	429	1,353	1,121	26	-	-	-	318	2,041	11,469
Senegal	-	300	45	-	309	-	-	-	28	111	1,273
Togo	103	948	74	39	-	22	-	-	-	107	1,762
Total	2,056	3,804	2,809	1,891	1,662	2,405	852	1,132	n.a.	3,000	40,658

Source: ISMA, Annual Phosphate Rock Statistics, 1971, (London: 1972).

APPENDIX IV.I.9.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1972.

(in thousand tons)

IMPORTER / EXPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	CZECHOSLOVAKIA	WORLD TOTAL
Jordan	-	-	-	-	-	-	50	-	392	180	41	952
Israel	-	68	34	150	63	-	45	-	-	20	-	638
Tunisia	22	450	61	36	105	451	74	103	-	-	243	2,305
Morocco	1,343	1,547	403	1,094	1,318	1,194	774	745	56	455	222	13,558
U.S.A.	602	398	1,393	677	49	-	-	-	397	2,080	-	12,464
Senegal	-	529	40	41	250	-	-	-	25	97	-	1,546
Togo	142	1,054	76	-	-	-	-	-	-	78	-	1,855
U.S.S.R. and North Vietnam	242	-	916	-	-	1,199	-	100	-	-	416	-
Total	2,347	4,120	2,869	2,003	1,786	2,665	949	1,285	n.a.	3,007	n.a.	43,511

Source: ISMA, Annual Phosphate Rock Statistics, 1972, (London:1973).

APPENDIX IV.I.10.

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1973.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUOSLAVIA	CHINA	INDIA	JAPAN	CZECHOSLOVAKIA	WORLD TOTAL
Jordan	-	-	-	-	-	-	38	-	344	195	41	1,080
Israel	-	81	-	112	111	-	87	-	-	2	-	540
Tunisia	56	513	83	36	127	185	23	12	-	-	243	2,225
Morocco	1,425	1,792	467	1,199	1,447	1,274	851	996	272	626	222	16,104
U.S.A.	869	441	1,126	544	137	113	-	37	229	1,964	-	12,623
Senegal	15	658	30	48	257	-	-	-	12	114	-	1,672
Togo	126	1,234	89	-	-	-	-	26	-	99	-	2,292
U.S.S.R and W. Vietnam	291	-	916	-	-	984	-	200	-	-	440	
Total	2,441	4,849	2,886	1,983	1,979	2,556	1,006	1,424	n.a.	3,271	n.a.	49,163

Source: ISMA, Annual Phosphate Rock Statistics, 1973, (London: 1974).

APPENDIX IV.I.11

WORLD LEADING EXPORTERS AND IMPORTERS OF PHOSPHATE ROCK, 1974.

(in thousand tons)

EXPORTER \ IMPORTER	BELGIUM	FRANCE	GERMANY	ITALY	BRITAIN	POLAND	YUGOSLAVIA	CHINA	INDIA	JAPAN	CZECHOSLOVAKIA	WORLD TOTAL
Jordan	-	-	-	-	-	-	84	-	549	258	49	1,447
Israel	-	137	9	62	5	-	39	-	-	18	-	752
Tunisia	46	598	78	39	126	200	29	-	-	-	257	2,407
Morocco	1,505	2,403	808	1,383	1,534	1,746	1,023	222	264	631	292	18,690
U.S.A.	544	317	1,204	468	92	274	-	40	253	2,259	-	12,915
Senegal	15	785	27	48	249	-	-	-	-	97	-	1,799
Togo	312	1,412	85	-	-	-	-	-	-	66	-	2,633
U.S.S.R and N. Vietnam	280	15	875	-	-	985	-	900	-	-	440	
Total	2,733	5,786	3,213	2,025	2,025	3,226	1,175	1,182	n.a.	3,942	n.a.	55,721

Source: ISMA, Annual Phosphate Rock Statistics, 1974, (London: 1975).

APPENDIX VI.J.

PHOSPHATE ROCK MAIN

IMPORTING COUNTRIES, 1964-1974

(in thousand tons)

YEAR	FRANCE	ITALY	BRITAIN	GERMANY	BELGIUM	JAPAN	CHINA	YUGOSLAVIA	POLAND
1964	2,494	1,716	1,510	2,199	1,117	2,348	784	642	549
1965	2,849	1,650	1,694	2,506	1,186	2,397	614	472	613
1966	2,978	1,880	1,649	2,560	1,200	2,526	736	699	359
1967	3,052	2,032	1,666	2,447	1,546	2,728	894	699	1,082
1968	3,403	2,192	1,870	2,726	1,827	3,465	895	891	1,505
1969	3,534	1,913	1,648	2,710	1,848	2,970	1,052	718	1,851
1970	3,703	2,053	1,602	2,997	1,828	3,131	1,094	842	2,076
1971	3,804	1,891	1,662	2,809	2,056	3,000	1,132	852	2,405
1972	4,120	2,003	1,786	2,869	2,347	3,007	1,285	949	2,665
1973	4,849	1,983	1,979	2,886	2,441	3,271	1,424	1,006	2,556
1974	5,786	2,025	2,025	3,213	2,733	3,943	1,182	1,175	3,226

Source: ISMA, Annual Phosphate Rock Statistics, 1964 - 1974,(London).

APPENDIX V.A.

POPULATION, GROSS NATIONAL PRODUCT AND PER CAPITA INCOME, (1954-1975).

YEAR	POPULATION OF THE EAST BANK (in millions)	TOTAL POPULATION (in millions)	EXPENDITURES ON G.N.P. (in millions of Jordanian Dinars)	PER CAPITA INCOME (in Jordanian Dinars
1950	0.600			
1951	0.626			
1952	0.587			
1953	0.587			
1954	0.620	1.39	52.4	37.7
1955	0.642	1.44	49.8	34.6
1956	0.663	1.48	68.5	46.3
1957	0.687	1.53	70.1	45.8
1958	0.720	1.58	77.1	48.8
1959	0.747	1.64	99.13	60.4
1960	0.781	1.69	105.69	62.5
1961	0.900	1.71	127.14	74.3
1962	0.932	1.77	130.83	73.9
1963	0.962	1.82	137.62	75.6
1964	0.992	1.88	160.62	85.4
1965	1.024	1.95	180.54	92.6
1966	1.059	2.01	185.78	92.4
1967	1.094	2.08	205.95	99.0
1968	1.126	2.15	197.28	91.8
1969	1.600	2.23	233.72	104.8
1970	1.668	2.31	222.50	96.3
1971	1.723	2.38	236.59	99.4
1972	1.774	2.47	263.03	106.5
1973	1.831	2.56	291.34	113.8
1974	1.870	2.64	373.95	141.7
1975	1.9	2.73	373.5	136.8

Source: (i) United Nations, Statistical Yearbooks, 1960-1973, (New York: U.N. Publications, relevant years), for data on total population, 1954-1973.

Source: (ii) Kingdom of Jordan, Department of General Statistics, Statistical Yearbook, 1973, (Amman: 1974), For data on the population of the East Bank for the period 1954 to 1973.

(iii) Hanna A. Odeh, Economic Development of Jordan, 1954 - 1971, (Amman: National Press, 1972), for data on G.N.P. for the period 1954 to 1969.

(iv) Kingdom of Jordan, Central Bank of Jordan, Annual Reports, 1970-1977, (Amman: National Press, relevant years), for data on G.N.P. for 1970 to 1975.

(v) United Nations, Statistical Yearbook, 1976, (New York: U.N. Publications, 1975), p.70, table 18.

APPENDIX V.B.

GROSS DOMESTIC PRODUCT
(AT FACTOR COST), 1954 - 1966

IN MILLIONS OF JORDANIAN DINARS

YEAR	AGRICULTURE FORESTY AND LIVESTOCK		MINING AND MANUFACTURING AND ELECTRICITY		CONSTRUCTION		TRANSPORTATION		TRADE AND BANKING		OWNERSHIP OF DWELLINGS		PUBLIC ADMINISTRATION AND DEFENCE		SERVICES		GROSS DOMESTIC PRODUCT (GDP).		GROSS NATIONAL PRODUCT. (at market price)	
	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change
1954	14.2	-	4.2	-	1.2	-	4.4	-	9.3	-	2.3	-	9.1	-	3.0	-	47.7	-	52.4	-
1955	6.2	-56.3	5.2	24.0	1.5	25.0	5.5	25.0	9.3	0	2.3	0	9.7	7.0	3.3	10.0	43.0	-10.0	49.8	-5.0
1956	19.0	206.5	6.3	21.2	1.7	13.3	6.8	24.0	10.3	13.0	2.9	26.0	11.5	19.0	2.7	-18.2	61.2	42.3	68.5	37.6
1957	12.8	-33.0	6.8	8.0	1.9	12.0	8.3	22.1	12.0	16.5	3.1	7.0	13.3	16.0	3.7	37.0	61.9	1.1	70.1	2.3
1958	12.9	1.0	7.6	11.8	2.4	26.3	9.0	8.4	14.4	20.0	3.3	6.5	15.6	17.3	3.9	5.4	69.1	12.0	77.1	10.0
1959	15.1	17.1	6.9	-9.2	4.7	95.8	10.7	18.9	18.8	30.6	6.2	87.9	15.0	3.8	7.8	100.0	85.2	23.3	99.1	28.5
1960	14.6	-3.3	7.6	10.1	4.5	-4.3	11.1	3.7	20.4	8.5	7.1	14.5	15.8	5.3	8.3	6.4	89.4	4.9	105.7	6.7
1961	25.3	73.3	9.5	25.0	4.5	0	12.6	13.5	25.6	25.5	8.1	14.1	16.7	5.7	8.6	3.6	110.9	24.1	127.1	20.3
1962	20.9	-17.3	8.8	-7.4	6.2	37.8	12.5	-1.0	25.1	-2.0	8.6	6.2	17.1	2.4	9.5	10.5	108.7	-2.1	130.8	2.9
1963	22.1	5.7	11.6	31.8	6.1	-1.6	12.8	2.4	27.8	10.8	9.4	9.3	17.6	2.9	10.4	9.5	117.8	8.4	137.6	5.2
1964	34.1	54.3	13.6	17.2	5.5	-9.8	12.0	-6.3	29.5	6.1	9.9	5.3	19.7	11.9	11.2	7.7	135.5	15.1	160.6	16.7
1965	34.1	0	17.9	31.6	7.9	43.6	12.6	5.0	33.5	13.6	10.7	8.1	21.4	8.6	12.8	14.3	150.9	11.4	180.5	12.4
1966	27.6	-19.1	19.2	7.3	9.3	17.7	14.4	14.3	31.7	-5.4	11.2	4.7	22.0	2.8	14.1	10.2	149.5	-1.0	185.8	2.9
Average 1954-1966	19.9	19.1	9.6	14.3	4.4	21.4	10.2	10.8	20.6	11.5	6.6	15.8	15.7	8.6	7.6	16.4	94.7	10.8	111.2	11.7

Source: (i) R.S. Porter, Economic Trends in Jordan, 1954 - 1959, (Beirut: Middle East Development Division, 1961), for data covering the period 1954 to 1959.

(ii) Kingdom of Jordan, Department of General Statistics, The National Accounts, 1959 to 1966 (Amman: Department of Statistics Press, 1967), for data covering the period 1959 to 1966.

APPENDIX V.C.

PRODUCTION OF PRINCIPAL INDUSTRIES, 1954-1975

YEAR	PHOSPHATES (DRY) in thousand tons	CEMENT in thousand tons	PETROLEUM PRODUCT in thousand tons	UPPER LEATHER in thousand square feet	LIQUID BATTERIES in thousand batteries	DETERGENTS in tons	CIGARETTES* in tons	ALCOHOLIC DRINKS AND SPIRITS in thousand litres	VEGETABLE OIL in tons
1954	75.0	86.0	-	-	-	-	-	-	-
1955	164.0	95.0	-	-	-	1.2	-	-	-
1956	208.4	79.3	-	-	-	1.3	0.6	317	-
1957	261.9	107.2	-	-	-	1.5	0.8	345	-
1958	293.9	114.2	-	-	-	1.7	0.7	478	-
1959	337.6	110.3	-	-	-	1.9	0.9	740	-
1960	361.8	164.8	-	-	-	2.9	0.9	1021	-
1961	422.5	223.1	204.8	-	-	2.5	1.0	1118	-
1962	681.0	235.3	274.5	1186	23.0	3.2	1.0	1063	3.2
1963	614.4	285.3	304.1	1564	26.9	2.8	1.0	1062	6.0
1964	564.5	307.8	327.9	1266	20.0	3.0	1.5	1315	5.8
1965	827.9	305.1	379.4	1817	41.0	3.4	1.2	1253	5.5
1966	1035.9	374.2	426.2	2354	60.0	4.2	1.5	1693	6.4
1967	1082.3	320.6	385.2	1671	45.6	2.0	1.8	1410	2.0
1968	1156.3	381.2	392.8	1678	59.6	2.0	1.6	1630	n.a.
1969	1089.0	480.6	463.7	1687	66.9	1.3	1.8	1809	n.a.
1970	938.9	377.5	445.8	1302	66.8	1.7	1.6	1766	n.a.
1971	640.0	418.9	556.7	1887.6	40.0	2.6	1.5	2396	n.a.
1972	709.0	661.3	605.1	2174.9	36.4	2.5	1.5	2421	n.a.
1973	1080.9	616.8	675.3	3750.5	40.1	2.7	2.2	2927	n.a.
1974	1674.8	614.7	648.4	2647.8	.0	3.0	2.0	3288	n.a.
1975	1352.5	598.2	828.2	2230.7	44.4	4.2	2.0	5503	n.a.

* Figures after 1967 exclude the West Bank.

Source: (i) Kingdom of Jordan, Department of General Statistics, Statistical Yearbooks, 1954-1970, (Amman: National Press, relevant years), for data covering the period 1954 - 1970.

(ii) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletins, Vol.10 No.3, March 1974 table (36) and vol 13, No.11, November 1972, table (44), for data covering the period 1971 - 1975.

APPENDIX V.D

PRODUCTION OF PRINCIPAL AGRICULTURAL CROPS, 1954-1975*

(in thousand tons)

YEAR	WHEAT	BARLEY	TOMATOES	MELONS	OLIVES	GRAPES	CITRUS FRUITS
1954	233.3	104.2	52.1	-	61.4	52.0	0.7
1955	79.4	25.4	48.0	-	12.0	31.5	1.0
1956	242.5	96.2	52.2	-	71.5	37.0	1.5
1957	219.8	80.6	65.4	-	14.0	47.0	2.0
1958	65.6	16.8	74.4	-	52.4	42.6	3.1
1959	103.5	26.0	126.1	-	11.2	54.1	5.8
1960	43.6	13.3	155.6	-	16.7	43.3	7.1
1961	138.2	61.7	213.8	-	114.4	78.4	16.3
1962	111.9	35.7	169.4	-	7.4	79.0	21.4
1963	75.8	23.0	214.6	120.4	38.7	58.7	38.8
1964	294.7	97.2	227.8	159.8	97.1	76.9	37.1
1965	277.9	94.8	188.9	160.1	37.4	79.2	47.0
1966	101.1	22.8	144.6	47.7	32.7	61.9	57.2
1967	196.1	63.4	216.3	58.3	22.2	28.1	29.0
1968	95.1	19.7	127.3	27.0	5.5	7.6	17.6
1969	159.3	42.5	150.1	30.0	19.4	14.2	24.3
1970	55.5	5.2	137.4	22.8	3.0	6.4	48.9
1971	168.1	26.2	137.0	27.1	18.5	18.6	41.2
1972	211.4	34.0	152.7	63.0	35.0	18.2	20.9
1973	50.2	5.9	82.0	55.4	5.6	22.1	11.9
1974	244.0	40.o	133.0	46.0	40.0	17.8	34.2
1975	50.0	11.8	145.1	50.3	4.7	11.1	12.8

* Figures after 1966 exclude the West Bank.

Source: (i) Kingdom of Jordan, Department of General Statistics, Statistical Yearbooks, 1954-1970, (Amman: National Press, relevant years), for data covering the period 1954 to 1969.

(ii) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletins, vol.10 No.3 March 1974, table (35) and Vol.13, No.11, November 1977, table (43).

APPENDIX V.E.

GROSS DOMESTIC PRODUCT

(AT FACTOR COST), 1967-1975

IN MILLIONS OF JORDANIAN DINARS

YEAR	AGRICULTURE FORESTRY AND LIVESTOCK		MINING AND MANUFACTURING		CONSTRUCTION		ELECTRICITY AND WATER SUPPLY		TRANSPORT		WHOLESALE AND RETAIL TRADE		BANKING AND FINANCE		OWNERSHIP OF DWELLINGS		PUBLIC ADMINISTRATION AND DEFENCE		OTHER SERVICES		GROSS DOMESTIC PRODUCT (GDP).		GROSS NATIONAL PRODUCT (at Market Prices	
	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	Value	% Change	VALUE	% CHANGE	VALUE	% CHANGE	VALUE	% CHANGE	VALUE	% CHANGE
1967	38.7	-	17.50	-	8.7	-	1.8	-	14.8	-	39.1	-	3.4	-	11.9	-	26.0	-	15.2	-	177.1	-	205.9	-
1968	27.5	-28.9	20.1	14.9	9.8	12.4	2.3	27.8	14.6	-1.4	29.1	-25.6	3.0	-11.8	12.3	3.4	33.2	27.7	16.6	9.2	168.5	-4.5	197.3	-4.2
1969	36.3	32.0	23.1	14.9	10.9	11.2	2.1	-8.7	16.0	9.6	38.4	32.0	4.2	40.0	12.8	4.1	36.3	9.3	18.3	10.2	198.4	17.8	233.8	18.5
1970	28.7	-20.9	19.8	-14.3	7.8	-28.4	2.4	14.3	15.9	-1.0	38.0	-1.0	4.2	0	13.6	6.5	37.9	4.4	21.3	16.4	189.6	-4.4	222.5	-4.8
1971	37.8	31.7	20.6	4.0	7.5	-3.9	2.7	12.5	16.2	1.9	39.0	2.6	3.4	19.1	14.4	5.9	39.0	2.9	22.0	3.3	202.6	6.9	236.6	6.3
1972	42.5	12.4	25.2	22.3	9.7	29.3	2.9	7.4	18.1	11.7	42.5	9.0	3.4	0	15.2	5.6	41.0	5.1	23.7	7.7	224.2	10.7	263.0	11.2
Average 1967-1972	35.3	5.3	21.1	8.4	9.1	4.1	2.4	10.7	15.9	4.2	37.7	3.4	3.6	9.5	13.4	5.1	35.6	9.9	19.5	9.4	193.4	5.3	226.5	5.4
1973	31.9	-	28.6	-	15.3	-	3.5	-	19.9	-	45.0	-	3.4	-	16.0	-	49.6	-	26.1	-	239.3	-	291.3	-
1974	54.5	70.9	49.1	71.7	17.0	11.1	3.7	5.7	25.3	27.1	52.0	15.6	3.8	11.8	17.5	9.4	54.8	10.5	3.9	18.4	308.6	29.0	374.0	28.4
1975	26.0	-52.3	48.8	-1.0	16.1	-5.3	3.1	-16.2	24.9	-1.6	43.9	-15.6	4.3	13.2	15.7	-10.3	56.1	2.4	30.6	-1.0	269.5	-12.7	373.5	0
Average 1973-1975	37.5	9.3	42.2	35.4	16.1	2.9	3.4	-5.3	23.4	12.8	47.0	0	3.8	12.5	16.4	-0.5	53.5	6.5	29.2	8.7	272.5	8.2	346.3	14.2

Source: (i) Kingdom of Jordan, Department of General Statistics, The National Accounts, 1967 - 1972, (Amman: Department of Statistics Press, 1973) for data covering the period 1967 to 1972.

(ii) Kingdom of Jordan, Central Bank of Jordan, Annual Reports, 1973 - 1977, (Amman: National Press, n.d.) for data covering the period 1973 to 1975.

APPENDIX V.F.

THE FUNCTIONAL DISTRIBUTION OF IMPORTS BY ECONOMIC FUNCTION, 1958-1975.

(in Million of Jordanian Dinars)

YEAR	TOTAL IMPORTS	CONSUMER GOODS	RAW MATERIALS	CAPITAL GOODS	MISCELLANEOUS
1958	34.0	23.4	9.0	2.6	-
1959	40.3	27.3	10.0	3.0	-
1960	42.9	28.6	10.8	3.5	-
1961	41.9	27.6	9.0	4.4	-
1962	45.6	27.9	12.7	5.0	-
1963	50.9	32.9	14.9	3.1	-
1964	53.6	34.8	14.6	4.2	-
1965	56.1	34.6	17.6	3.9	-
1966	68.2	42.2	20.3	5.7	-
1967	55.1	23.9	13.7	14.8	2.7
1968	57.5	27.6	12.2	13.9	3.8
1969	67.8	33.9	14.6	15.2	4.0
1970	65.9	33.0	15.1	13.4	4.34
1971	76.6	33.4	13.6	17.6	12.0
1972	95.3	46.3	18.8	18.6	11.6
1973	108.2	50.6	22.2	20.2	15.2
1974	156.2	69.6	30.0	40.9	16.0
1975	334.0	90.5	57.2	82.9	3.4

Source: (i) H.A. Odeh, The Economic Development of Jordan 1954-1971, (Amman: National Press, 1972), for data covering the period 1958 to 1967.

(ii) Kingdom of Jordan, Central Bank of Jordan, Monthly Statistical Bulletin, Vol.5, No.12, December 1969; vol.9, No.8, August 1973; and Vol.13, No.3, March 1977.

APPENDIX V.G*

THE PROCESS OF PLANNING IN JORDAN:

(1) The planning process starts with the establishment of a higher planning committee with the aim of formulating the objectives of the plan, and the amount of money to be invested over the plan period in each of the economic sectors.

(2) The Higher Committee then asks each ministry to prepare and present a list of the projects it intends to construct during the currency of the plan. The proposals by each ministry should include justifications for each project, their objectives, costs and the expected benefits to the economy in the event of the project being implemented.

(3) After receiving the proposals from each ministry, the Higher Committee appoints Sub-Committees each headed by at least one member of the Higher Committee. The job of these Sub-Committees is to study the proposals with the departments concerned, define the priorities for such proposals, specify possible ways of financing each project, and prepare a draft of the plan for all the economic sectors.

(4) The draft is then presented to the Higher Committee for analysis and modification in terms of overall priorities. The Higher Committee also defines the organizational measures needed for each economic sector.

(5) The revised and modified draft is then presented to all ministries for final inspection.

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* Kingdom of Jordan, interviews with a number of members of staff of the National Planning Council, August 1976.

(6) The Higher Committee then prepares the final draft and sends it to the Council of Ministers for approval.

In determining priorities of projects, the following considerations are usually applied:

(1) The completion of on-going projects or those for which steps have already been taken to commence execution.

(2) The contributions of the project to the productive capacity of the national economics, and to earnings of Foreign exchange.

(3) The contribution of the project to the development and utilization of local natural resources and its role in enhancing complementarity and integration among the economic activities in the country.

(4) The extent to which preparatory phases of the project are completed, in terms of studies and detailed engineering.

(5) Finally, the organizational and managerial capabilities needed to implement the project according to the established time - schedule.

APPENDIX V.H

RELATIVE IMPORTANCE OF ECONOMIC SECTORS TO GROSS DOMESTIC PRODUCT AND GROWTH, 1954 - 1975

VALUES IN MILLIONS OF JORDANIAN DINARS

AVERAGE	AGRICULTURE			MINING AND INDUSTRY			SERVICES			GROSS DOMESTIC PRODUCT	
	Value	% Change	Ratio to GDP.	Value	% Change	Ratio to GDP.	Value	Change	Ratio to GDP.	Value	% Change
1954-1966	19.9	19.1	21.2	13.9	35.7	14.5	60.7	62.5	64.3	94.7	10.8
1967-1972	35.3	5.3	18.3	32.6	23.2	16.8	125.7	41.5	64.9	193.4	5.3
1973-1975	37.5	9.3	13.8	61.7	33.0	22.8	173.3	40.0	63.4	272.5	8.2
1954-1975	30.9	11.2	17.8	36.1	30.6	18.0	119.9	48.0	64.2	186.9	8.1
Average annual growth of G.N.P. over the period, 1954 - 1975 = 10.4 per cent.											

Source: Appendices V.B and V.C.

APPENDIX VI.A

RAW PHOSPHATE RESERVES AT EL-HASA AS OF 31.12.1975.

MILLSITE/OREBODY	PROVED				INDICATED							
	RAW ORE		PROTORE		RAW ORE		PROTORE		INFERRED		POTENTIAL	TOTAL
	TCP% Grade	Million tons	TCP% Grade	Million tons	TCP% Grade	Million tons	TCP% Grade	Million tons	TCP% Grade	Million tons	Million tons	Million tons
Millsite No.1 Orebody No.1	69	0.84										0.84
Orebody No.2	68	3,62	55.6	1.20							6.00	10.82
Orebody No.4	66.5	6.85	55.2	2.10								8.95
Orebody No.5	68.3	3.40	56.1	0.80	68.3	1.50	56.1	3.00				8.70
Orebody No.9	67.4	21.90	55.0	7.33								29.23
Orebody No.11	68	1.67	55.6	0.66	68	2.48	55.6	0.92			6.00	11.73
Orebody No.12					66	3.00			66	2.50		5.50
Orebody No.20					67	10.00					7.00	17.00
Total M.1	67.4%	38.28	55.4%	12.09	67%	16.98	56.0%	3.92	66%	2.50	19.00	92.77
Millsite No.2 Orebody No.3	69.4	9.40	52	2.82								12.22
3 (East Ext.)	68.4	4.00	50	0.70							10	14.7
(3A+3B)	67.7	8.90	50	2.29								11.19
O.B.No.10	66.3	1.74	57.6	0.52							5.0	7.26
Total M.2	68.4%	24.04	51.1%	6.33							15.0	45.37

APPENDIX VI.A (continued)

RAW PHOSPHATE RESERVES AT EL-HASA AS OF 31.12.75.

MILLSITE/OREBODY	PROVED				INDICATED				INFERRED		POTENTIAL	TOTAL
	RAW ORE		PROTORE		RAW ORE		PROTORE					
	TCP% Grade	Million tons	TCP% Grade	Million tons	TCP% Grade	Million tons	TCP% Grade	Million tons	TCP% Grade	Million tons	Million tons	Million tons
Millsite No.3 Orebody No.6	67.8	1.35									2.00	3.35
Orebody No.7	66.4	11.34	55.5	2.50	66.4	11.79	55.5	1.55			25.00	52.18
Orebody No.8	69.1	1.10									2.00	3.10
Total M.3	66.7%	13.79	55.5	2.50	66.4	11.79	55.5	1.55			29.0	58.63
Millsite No.4 Orebody No.21					24.50				67.25		15.25	107.00
Orebody No.22					21.00				66.85		57.65	115.50
Orebody No.23					11.50				23.20		45.90	80.60
Total M.4					57.00				157.30		118.80	330.10
Millsite No.5 O.B.13					10				28		8	16.0
O.B.14					6.58				4.90		5.15	16.63
O.B.15					11.90				50.90		101.00	163.80
O.B.16					26.72				68.50		49.55	144.77
Total M.5					55.20				152.30		163.70	371.20
Miscellaneous O.RS 17.18.19					2.56				1.80		1.64	6.00
Grand Total - El Hasa	67.6%	76.11	54.1%	20.92	149				313.9		347.14	907.07

Source: Kingdom of Jordan, J.P.M.C., (Amman: 1976).

APPENDIX VI.B

ESTIMATED RAW PHOSPHATE RESERVES AT RUSEIFA AND MADABA, AS OF END - 1975 (IN THOUSAND TONS).

Millsite	Orebody/Area	Average TCP%	PROVED	INDICATED	INFERRED	POTENTIAL	TOTAL
M.1	South West Area	67	1,300	-	-	-	1,300
	Greater South Area	68	7,500	-	-	-	7,500
M.2	Zerqa "A" Area	62.3	18,700	-	-	-	18,700
	Zerqa "B" Area	65	10,500	22,500	39,000	-	72,000
M.3	Madaba	50	-	-	-	60,000	60,000
TOTAL		64.4	38,000	22,500	39,000	60,000	159,500

Source: Kingdom of Jordan, J.P.M.C., (Amman: 1976).

APPENDIX VI.C

PRELIMINARY ESTIMATES OF MINEABLE ORE RESERVES AT SHIDIYA (AS OF DECEMBER 1975)*.

Phosphate Protore	Proved		Indicated		Potential	Total
	Million Tons	TCP%	Million Tons	TCP%	Million Tons	Million Tons
Top Protore	44.74	48.5	45.00	48		89.74
Soft Phosphate	51.50	65.6	50.00	65		101,50
Sandy Phosphate	34,00	47	45.00	46		79.00
TOTAL	130.24	55	140.00	54.2	300	570.24

* Stripping Ratio averages approximately 1:5

Source: Kingdom of Jordan, J.P.M.C.,(Amman: 1975).

APPENDIX VI.D.

SUGGESTED POSSIBLE RATES OF PRODUCTION AND LIVES OF OPERATION BASED ON MINEABLE RESERVES •

Mine/Millsite/Orebody	Mineable Reserves (Proved and Indicated) (Million Tons)	Other Reserves (Million Tons)	Production Rate/Year (Dry Product) (in Mill.Tons/Year)	Life of Operation (Years)
EL-HASA				
Millsite 1 - O.B: 1,2,4,5,9,11,12 and 20	71	21	3.1 dry (with 50% recovery)	1976 - 1987
Millsite 2 - O.B: 3,3A.3B and 10	30	15	1.5 "	1977 - 1986
Millsite 3 - O.B: 6,7, and 8	29	30	1.5 "	1981 - 1991
Millsite 4 - O.B: 21,22 and 23	57	276	3.0 "	1985 - 1995
Millsite 5 - O.B: 13,14,15 and 16	55	316	3.0 "	1983 - 1992
RUSEIFA				
Millsite 1 - South	9	-	0.9 dry or 2.2 raw	1976 - 1980
Millsite 2 - North	52	39	1.5 dry or 3 raw	1980 - 1997
SHIDIYA	270	300	5 dry or 10 raw	1982 - 2010

Source: Kingdom of Jordan, J.P.M.C, (Amman: 1976).

APPENDIX VI.E.

CHEMICAL ANALYSIS OF PHOSPHATE ROCK CONTENT*

	70/72 TCP Russeifa Grade Product	70/72 TCP El-Hassa Grade Product	73/75 TCP El-Hassa Grade Product	75/77 TCP El-Hassa Grade Product
P_2O_5	32.34	33.36	33.90	34.60
CaO	52.22	49.90	52.30	52.70
Fe_2O_3 + al_2O_3	0.51	0.88	0.47	0.47
cl	0.13	0.41	0.03	0.05
P	3.63	3.70	3.86	3.96
CO_2	5.10	3.80	4.00	3.60
Insoluble silicious matter	3.28	5.13	2.62	2.00
Organic matter	0.31	0.34	0.30	0.27
Moisture content	1.50	1.50	1.50	1.50
Loss on ignition	6.80	5.75	6.06	5.62

* Percentages do not add to 100 percent

Source: (i) An unpublished report prepared by the Arab League and submitted to the Jordanian Government, 1976, pp.50-51.

(ii) Kingdom of Jordan, J.P.M.C., Quality and Control Department, (Amman: 1976),

APPENDIX VI.F

OUTPUT AND CAPITAL AND LABOUR INPUTS FOR THE PHOSPHATE ROCK INDUSTRY IN JORDAN, 1960 - 1974.

YEAR	OUTPUT (IN TONS)	TOTAL ASSETS ADJUSTED FOR INFLATION (In Jordanian Dinars)	LABOUR HOURS
1960	391,640	1,509,458	3,308,448
1961	444,957	1,685,436	3,761,472
1962	681,010	2,345,728	4,129,840
1963	615,436	2,821,915	2,729,584
1964	603,862	2,611,620	1,825,824
1965	842,428	2,708,126	2,516,800
1966	1,000,765	3,587,946	2,690,688
1967	1,236,997	6,293,072	3,285,568
1968	1,590,866	7,493,532	3,294,720
1969	1,320,610	6,636,268	2,807,376
1970	1,099,179	6,073,269	2,077,504
1971	786,360	6,269,498	2,278,848
1972	1,085,019	6,221,760	2,676,960
1973	1,523,888	5,902,952	3,422,848
1974	2,147,380	9,551,394	4,360,928

Source: Kingdom of Jordan, J.P.M.C, Annual Reports, 1960 - 1974, (Amman).

APPENDIX VI.G

PRODUCTION AND CAPITAL AND LABOUR

INPUTS FOR THE CEMENT

INDUSTRY IN JORDAN, 1954 - 1973.

YEAR	PRODUCTION (IN TONS.)	TOTAL ASSETS ADJUSTED FOR INFLATION (in Jordanian Dinars)	LABOUR HOURS
1954	90,416	1,376,729	542,256
1955	101,332	1,471,057	608,608
1956	111,152	1,550,696	622,336
1957	111,195	1,608,192	585,728
1958	111,766	2,099,451	574,288
1959	115,739	2,039,919	661,232
1960	198,223	2,908,380	890,032
1961	238,459	3,069,007	894,608
1962	255,864	3,202,678	938,080
1963	305,020	3,102,538	1,086,800
1964	332,588	4,356,686	1,096,240
1965	373,388	4,302,240	1,166,880
1966	386,217	4,495,318	1,256,112
1967	405,713	6,550,222	1,352,208
1968	369,005	7,413,938	1,384,240
1969	580,141	7,177,284	1,624,480
1970	464,548	6,537,310	1,546,688
1971	526,644	6,581,021	1,436,864
1972	661,623	5,563,893	1,408,952
1973	616,786	5,457,435	1,473,897

Source: Kingdom of Jordan, The Jordan Cement Factories Limited, Annual Reports, 1954 - 1973, (Amman).

APPENDIX VII.A

VALUE ADDED AND WAGES AND SALARIES

OF MAIN INDUSTRIES IN JORDAN

(Values in Thousand Jordanian Dinars).

Industry	1965			1966			1974		
	No. of Employees	Wages and Salaries	Value Added	No. of Employees	Wages and Salaries	Value Added	No. of Employees	Wages and Salaries	Value Added
Phosphates	1,021	291	1,057	1,010	345	1,160	1,906	1,286	19,280
Tobacco	886	251	799	856	279	850	-	-	-
Paper Products	261	28	80	359	40	113	-	-	-
Petroleum Refining	775	379	1,976	758	442	2,146	-	-	-
Cement	510	189	1,369	595	218	1,651	-	-	-
Basic Metal Products	4,194	409	1,117	4,037	416	987	-	-	-
Industrial Sector	37,094	5,266	16,214	37,257	5,583	17,267	-	-	-
Pharmaceuticals	66	32	86	-	-	-	-	-	-

Sources: (i) Kingdom of Jordan, Department of General Statistics, National Accounts, 1959 - 1965, (Amman: 1966).

(ii) Kingdom of Jordan, Department of General Statistics: Industrial Census, 1974, (Amman: February 1976).

(iii) United Nations, United Nations Economic and Social Office in Beirut, Situation of Industry as a Whole and of Small Scale Industry in Particular, in Jordan, (Beirut: 1968).

(iv) Economist Intelligence Unit, The Expansion of the Phosphate Industry in Jordan, (London: 1965) p.1.

(v) M.R. Freeman, 'Phosphate Rock', Annual Mining Review, 1973, p.100.

(vi) United States Bearue of Mines, Mineral Yearbook, 1973, (New York: 1974), pp 8-10.

APPENDIX VIII.A.

SIZES OF SHIP TRANSPORTING JORDANIAN PHOSPHATE ROCK IN 1966 AND 1971 (in thousand tons)

DESTINATION	BY LAND		BY SEA										
	EXPORTS OF 1966												
		%	UNDER 5,000 DWT	%	5,000 to 10,000 D.W.T.	%	10,000 to 20,000 D.W.T.	%	20,000 to 30,000 D.W.T.	%	OVER 30,000 DWT	%	TOTAL
Italy	-	-	108.6	95.6	5.0	4.4	-	-	-	-	-	-	113.6
Czechoslovakia	-	-	58.7	100.0	-	-	-	-	-	-	-	-	58.7
Yugoslavia	-	-	173.1	89.2	21.0	10.8	-	-	-	-	-	-	194.1
Ceylon	-	-	12.1	100.0	-	-	-	-	-	-	-	-	12.1
China	-	-	-	-	32.9	100	-	-	-	-	-	-	32.9
India	-	-	3.0	1.0	56.9	18.8	243.1	80.2	-	-	-	-	303.0
Lebanon	38.8	100.0	-	-	-	-	-	-	-	-	-	-	38.8
Syria	1.5	100.0	-	-	-	-	-	-	-	-	-	-	1.5
Total	40.3	5.3	355.5	47.1	115.8	15.4	243.1	32.2	-	-	-	-	754.7
	EXPORTS OF 1971												
Czechoslovakia	-	-	30.8	100.0	-	-	-	-	-	-	-	-	30.8
Rumania	-	-	10.3	100.0	-	-	-	-	-	-	-	-	10.3
Yugoslavia	-	-	74.5	58.9	52.1	41.1	-	-	-	-	-	-	126.6
Ceylon	-	-	8.4	100.0	-	-	-	-	-	-	-	-	8.4
India	-	-	19.7	7.9	150.1	60.2	79.4	31.9	-	-	-	-	249.2
Japan	-	-	7.6	15.7	40.9	84.3	-	-	-	-	-	-	48.5
Lebanon	101.1	100.0	-	-	-	-	-	-	-	-	-	-	101.1
Syria	0.4	100.0	-	-	-	-	-	-	-	-	-	-	0.4
Taiwan	-	-	-	-	19.7	100.0	-	-	-	-	-	-	19.7

APPENDIX VIII.A. (continued)

SIZES OF SHIP TRANSPORTING JORDANIAN PHOSPHATE ROCK IN 1966 and 9171

(in thousand tons)

DESTINATION	BY LAND		BY SEA										
			EXPORTS OF 1971										
		%	UNDER 5,000 DWT	%	5,000 to 10,000 D.W.T.	%	10,000 to 20,000 D.W.T.	%	20,000 to 30,000 D.W.T.	%	OVER 30,000 DWT	%	TOTAL
Turkey	-	-	56.0	100.0	-	-	-	-	-	-	-	-	56.0
Total	101.5	15.6	207.3	31.8	262.8	40.4	79.4	12.2	-	-	-	-	651.0

Source: International Superphosphate Manufacturers' Associatin (I.S.M.A.) ,(London: 1972).

APPENDIX VIII.B.

AN ANALYSIS OF THE SHIPS LOADING PHOSPHATE ROCK AT AQABA BY FLAG AND YEAR OF BUILD: 1974

(Vessel Numbers and 000 DWT)

FLAG \ BUILT	Pre 1940		1940/44		1945/49		1950/54		1955/59		1960/64		1965/69		1970/75		TOTALS		Ave. Size	%
India	-	-	3	32.2	5	63.2	1	9.0	14	116.1	1	4.9	6	47.9	-	-	30	273.3	9,110	23.2
Panama	1	9.1	2	15.2	11	100.1	4	42.7	2	22.0	3	16.8	-	-	-	-	23	205.9	8,950	17.5
Japan	-	-	-	-	-	-	-	-	3	33.4	4	39.6	5	63.4	7	87.3	19	223.7	11,775	19.0
Singapore	-	-	3	28.2	-	-	2	18.1	6	70.3	1	2.8	-	-	-	-	12	119.4	9,950	10.1
Greece	-	-	1	8.9	-	-	4	39.2	4	45.3	1	23.2	-	-	1	14.9	11	131.5	11,950	11.1
Cyprus	-	-	1	8.4	3	31.5	2	19.7	1	10.8	-	-	-	-	-	-	7	70.4	10,050	6.0
Maldive	-	-	-	-	1	5.7	5	21.1	-	-	-	-	-	-	-	-	6	26.8	4,460	2.3
Taiwan	-	-	-	-	-	-	1	9.9	2	18.0	-	-	2	18.4	-	-	5	46.3	9,260	3.9
Yugoslavia	-	-	-	-	-	-	-	-	-	-	3	11.1	-	-	-	-	3	11.1	3,700	0.9
Liberia	-	-	-	-	1	9.0	1	4.7	-	-	-	-	-	-	-	-	2	13.7	6,850	1.2
Somalia	-	-	-	-	-	-	1	10.4	-	-	1	9.1	-	-	-	-	2	19.5	9,750	1.6
UK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	18.3	1	18.3	18,300	1.5
Algeria	-	-	-	-	-	-	1	5.8	-	-	-	-	-	-	-	-	1	5.8	5,800	0.5
Philippines	-	-	-	-	-	-	1	1.0	-	-	-	-	-	-	-	-	1	1.0	1,000	0.1
Pakistan	-	-	-	-	-	-	-	-	1	12.3	-	-	-	-	-	-	1	12.3	12,300	1.0
Totals	1	9.1	10	92.9	21	209.5	23	181.6	33	328.2	14	107.5	13	129.7	9	120.5	124	1,179.0	9,500	
Average Size	9,100		9,290		9,975		7,895		9,945		7,680		9,975		13,390		9,500			
%	0.8		7.9		17.8		15.4		27.8		9.1		11.0		10.2					100.0

Source: H.P. Drewery Limited, Phosphate Rock, Shipping Through the Port of Aqaba, Jordan, (London: 1975).

APPENDIX VIII.C.

AN ANALYSIS OF THE SHIPS LOADING PHOSPHATE ROCK AT AQABA BY LAST PORT OF CALL AND FLAG:1974

DISCHARGE PORT \ FLAG	INDIA	PANAMA	JAPAN	SINGAPORE	GREECE	CYPRUS	MALDIVE	TAIWAN	YUGOSLAVIA	LIBERIA	SOMMALIA	GREAT BRITAIN	ALGERIA	OTHERS	TOTALS	AVERAGE SIZE	PERCENTAGE
Red Sea :	16	18	18	9	7	5	5	4	3	2	1	1	1	1	91	-	-
	140.2	154.6	211.0	85.9	74.4	47.9	23.3	40.7	11.1	13.7	9.1	18.3	5.8	1.0	837.0	9,200	71.0
Port Sudan	5	2	4	2	2	1	3	1	2	-	-	-	1	-	23	-	-
	43.1	18.4	48.9	22.7	18.9	10.5	14.8	12.8	7.4	-	-	-	5.8	-	203.3	8,840	17.2
Jeddah	4	15	7	5	4	3	2	3	1	2	1	1	-	1	49	-	-
	43.1	125.0	77.3	38.0	44.3	26.6	8.5	27.9	3.7	13.7	9.1	18.3	-	1.0	436.5	8,900	37.0
Hodeidah	-	-	5	1	-	-	-	-	-	-	-	-	-	-	6	-	-
	-	-	59.2	13.3	-	-	-	-	-	-	-	-	-	-	72.5	12,080	6.1
Safaga	7	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-
	54.0	-	-	-	-	-	-	-	-	-	-	-	-	-	54.0	7,710	4.6
Massawa	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
	-	-	-	-	11.2	-	-	-	-	-	-	-	-	-	11.2	11,200	0.9
Assab	-	-	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
	-	-	25.6	11.9	-	-	-	-	-	-	-	-	-	-	37.5	12,500	3.2
Yenbo	-	1	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-
	-	11.2	-	-	-	10.8	-	-	-	-	-	-	-	-	22.0	11,000	1.9
Gulf of Aden :	8	-	-	1	1	-	1	-	-	-	1	-	-	-	12	-	-
	73.2	-	-	9.5	14.0	-	3.5	-	-	-	10.4	-	-	-	110.6	9,215	9.4
Djibouti	4	-	-	1	-	-	-	-	-	-	-	-	-	-	5	-	-
	33.6	-	-	9.5	-	-	-	-	-	-	-	-	-	-	43.1	8,620	3.7
Aden	4	-	-	-	1	-	1	-	-	-	1	-	-	-	7	-	-
	39.6	-	-	-	14.0	-	3.5	-	-	-	10.4	-	-	-	67.5	9,640	5.7
Arabian Gulf :	2	2	-	1	1	-	-	-	-	-	-	-	-	1	7	-	-
	24.9	22.1	-	11.0	23.2	-	-	-	-	-	-	-	-	12.3	93.5	13,350	7.9
Basrah	-	1	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-
	-	13.0	-	-	-	-	-	-	-	-	-	-	-	12.3	25.3	12,650	2.1
Bahrain	-	1	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-
	-	9.1	-	11.0	-	-	-	-	-	-	-	-	-	-	20.1	10,050	1.7

APPENDIX VIII.C. (continued)

AN ANALYSIS OF THE SHIPS LOADING PHOSPHATE ROCK

AT AQABA BY LAST PORT OF CALL AND FLAG:1974

DISCHARGE PORT \ FLAG	INDIA	PANAMA	JAPAN	SINGAPORE	GREECE	CYPRUS	MALDIVE	TAIWAN	YUGOSLAVIA	LIBERIA	SOMMALIA	GREAT BRITAIN	ALGERIA	OTHERS	TOTALS	AVERAGE SIZE	PERCENTAGE
Bandar Shahpour	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
	-	-	-	-	23.2	-	-	-	-	-	-	-	-	-	23.2	23,200	2.0
Bushire	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	12.1	12,100	1.0
Dubai	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	12.8	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	12,800	1.1
Indian Cont :	2	-	-	1	2	1	-	-	-	-	-	-	-	-	6	-	-
	26.3	-	-	13.0	19.9	10.5	-	-	-	-	-	-	-	-	69.7	11,620	5.9
Karachi	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
	-	-	-	-	10.9	-	-	-	-	-	-	-	-	-	10.9	10,900	0.9
Bombay	2	-	-	1	1	-	-	-	-	-	-	-	-	-	4	-	-
	26.3	-	-	13.0	9.0	-	-	-	-	-	-	-	-	-	48.3	12,075	4.1
Madras	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-
	-	-	-	-	-	10.5	-	-	-	-	-	-	-	-	10.5	10,500	0.9
Other :	2	3	1	-	-	1	-	1	-	-	-	-	-	-	8	-	-
	8.7	29.2	12.7	-	-	12.0	-	5.6	-	-	-	-	-	-	68.2	8.525	5.8
Mombasa	-	2	-	-	-	1	-	-	-	-	-	-	-	-	3	-	-
	-	21.6	-	-	-	12.0	-	-	-	-	-	-	-	-	33.6	11.200	2.8
Kobe	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	-	-	12.7	-	-	-	-	-	-	-	-	-	-	-	12.7	12.700	1.1
Other	2	1	-	-	-	-	-	1	-	-	-	-	-	-	4	-	-
	8.7	7.6	-	-	-	-	-	5.6	-	-	-	-	-	-	21.9	5,475	1.9
Overall Totals	30	23	19	12	11	7	6	5	3	2	2	1	1	2	124	-	-
	273.3	205.9	223.7	110.1	131.5	70.1	20.8	46.8	11.1	13.7	19.5	18.3	5.8	18.3	1,170.0		-
Average Size	9,110	8,950	11,775	9,950	11,950	10,050	4,460	9,260	3,700	6,850	9,750	18,300	5,800	6,650	-	9,500	-
%	23.2	17.5	19.0	10.1	11.1	6.0	2.3	3.9	0.9	1.2	1.6	1.5	0.5	1.1	-	-	100.0

Source: H.P.Drewery Limited., Phosphate Rock Shipping Through The Port of Aqaba, Jordan, (London: 1975).

APPENDIX VIII.D.

TOTAL JORDANIAN EXPORTS OF PHOSPHATE ROCK AND THE MAIN IMPORTERS, 1960-1975

(in tons)

YEAR	TOTAL EXPORTS	INDIA	YUGOSLAVIA	TURKEY	CZECHOSLOVAKIA	ITALY	LEBANON
1960	329,006	72,012	149,400	-	48,465	-	9,764
1961	391,715	106,950	184,719	-	64,200	-	8,706
1962	371,640	128,682	134,472	-	81,073	-	13,244
1963	368,504	95,796	164,636	-	60,750	2,000	13,962
1964	627,074	119,138	184,635	96,290	78,440	44,962	20,540
1965	604,648	138,607	180,021	5,300	68,711	83,872	42,678
1966	754,736	302,974	194,095	-	58,735	113,620	38,787
1967	881,658	353,672	130,815	58,220	60,400	208,452	4,354
1968	1,095,227	478,880	210,400	98,910	35,680	13,130	124,076
1969	928,296	367,597	249,430	77,505	72,655	-	91,685
1970	658,056	62,520	192,770	100,690	47,930	-	141,626
1971	650,833	249,253	126,555	55,980	30,755	-	101,130
1972	952,371	391,985	49,850	80,630	51,550	-	90,400
1973	1,089,518	343,537	38,150	120,929	41,450	-	121,975
1974	1,468,894	548,919	83,785	123,241	49,250	-	127,984
1975	1,111,877	111,450	27,230	179,629	70,670	80,660	48,714

APPENDIX VIII.D. (continued)

TOTAL JORDANIAN EXPORTS OF PHOSPHATE ROCK AND THE MAIN IMPORTERS, 1960-1975

(in tons)

YEAR	TOTAL EXPORTS	JAPAN	PEOPLES REPUBLIC OF CHINA.	POLAND	CHINA	ROMANIA	BULGARIA	TANZANIA	PAKISTAN
1960	329,006	-	-	39,115	-	-	-	-	-
1961	391,715	17,040	-	10,100	-	-	-	-	-
1962	371,640	4,667	-	9,400	-	-	-	-	-
1963	368,504	-	-	20,350	-	-	-	-	-
1964	627,074	38,776	-	-	-	-	24,124	-	8,890
1965	604,648	41,865	-	-	-	-	30,467	-	-
1966	754,736	-	32,899	-	-	-	-	-	-
1967	881,658	7,672	27,295	-	-	5,500	-	-	12,252
1968	1,095,227	25,540	55,500	-	-	-	-	-	29,202
1969	928,296	8,695	67,020	-	13,200	-	-	-	7,400
1970	658,056	4,862	58,700	-	10,000	6,100	-	-	29,254
1971	650,833	48,455	-	-	19,700	10,250	-	-	-
1972	952,371	179,596	-	-	48,400	-	-	36,200	20,460
1973	1,089,518	194,807	-	-	81,110	-	-	30,100	22,000
1974	1,468,894	258,379	-	-	98,250	-	10,150	80,186	43,200
1975	1,111,877	90,050	-	23,200	124,870	175,410	55,844	33,050	-

APPENDIX VIII.D. (continued)

TOTAL JORDANIAN EXPORTS OF PHOSPHATE ROCK AND THE MAIN IMPORTERS, 1960-1975

(in tons)

YEAR	TOTAL EXPORTS	FRANCE	SPAIN	CEYLON	KOREA	BANGLADESH	GREECE	MALAYSIA
1960	329,006	-	6,750	-	-	-	3,400	-
1961	391,715	-	-	2,500	-	-	-	-
1962	371,640	-	-	-	-	-	-	-
1963	368,504	-	-	10,760	-	-	-	-
1964	627,074	3,220	-	7,836	-	-	-	-
1965	604,648	-	-	6,932	-	-	-	-
1966	754,736	-	-	12,096	-	-	-	-
1967	881,658	-	-	11,720	-	-	-	-
1968	1,095,227	-	-	22,403	-	-	-	-
1969	928,296	-	-	1,829	-	-	-	-
1970	658,056	-	-	2,215	-	-	-	-
1971	650,833	-	-	8,398	-	-	-	-
1972	952,371	-	-	3,300	-	-	-	-
1973	1,089,518	-	-	5,900	10,500	-	-	4,000
1974	1,468,894	-	-	2,500	10,100	-	-	16,800
1975	1,111,877	48,950	-	16,000	-	15,000	3,150	5,500

APPENDIX VIII.D. (continued)

TOTAL JORDANIAN EXPORTS OF PHOSPHATE ROCK AND THE MAIN IMPORTERS, 1960-1975.

(in tons)

YEAR	TOTAL EXPORTS	INDONESIA	CAMBODIA	SYRIA	BRITAIN
1960	329,006	-	-	-	-
1961	391,715	-	-	-	-
1962	371,640	-	-	-	-
1963	368,504	-	-	-	-
1964	627,074	-	-	213	10
1965	604,648	-	-	228	-
1966	754,736	-	-	1,350	-
1967	881,658	-	-	1,306	-
1968	1,095,227	-	-	1,506	-
1969	928,296	-	-	1,300	-
1970	658,056	-	-	1,389	-
1971	650,833	-	-	357	-
1972	952,371	-	-	-	-
1973	1,089,518	-	-	-	-
1974	1,468,894	-	2,500	-	-
1975	1,111,877	2,500	-	-	-

Source: Kingdom of Jordan, J.P.M.C., Annual Reports, 1960 -1975, (Amman)